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THE SMALLER FUNGI.*

BY JOHN L. RUSSELL.

Almost everybody supposes that there can be no doubt as to what a toadstool, a mildew or a mould is, and some may even correctly call them fungi, if they are acquainted with the Latin word, which denotes them. Rust on grain, and smut on maize or Indian corn, are also familiar to farmers, but a multitude of other of the smaller fungi, are only known to the botanist. An accurate knowledge of them is to be found only with the mycologist, who as a botanist, devotes unceasing and strict attention to this particular department of natural history. Abroad it is to the researches of many eminent men and women on the continent and Great Britain, and in this country to several others both dead and living, that the structure, mode of growth, relation to the various departments of industry, injurious effects and general utility of these smaller fungi in nature, are collected and known.

As plants, though of a very low order of organization, the smaller fungi treated of in the work before us, are of great interest as mere objects of beauty. To attain a full comprehension of this fact, recourse must be had to the microscope,

*Rust, Smut, Mildew and Mould. An Introduction to the Study of Microscopic Fungi, by M. C. Cooke, with nearly 300 figures by J. E. Sowerby. London. 12mo, pp. 238, 1865.

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because the several portions of these structures are beyond the reach of the unaided vision. No one, who does not know, could possibly conceive that the little specks of brown or black seen on the brilliant and ripening foliage of the maples in September and October, (or to be seen on the skin of apples and pears, and many kinds besides on dry stalks of plants, on straw, on old decaying matter,) on the fence rails, on the panes of the window, on the bodies of diseased house-flies, on putrefying and decaying matter, are receptacles of exquisitely sculptured and carved seed-vessels, called *spores;* beaded thread-like strings of pearls; or of myriads of the most fantastic shapes that the genius of man in imitative or creative art has developed. A subject so broad, and one which can be investigated at any season of the year, inviting the botanist forth from earliest spring to latest autumn, to search for forms of beauty on every living or ripening leaf and fruit, and in winter rendering the evening lamp still more attractive in studying by its aid the collected treasures of the summer's gleanings, cannot but interest every thoughtful person in some way or other, if it should be presented in an agreeable manner, or with reference to the industrial pursuits of society.

Nor only to the general botanist, or even to the botanist whose speciality is the study of fungi, is this subject one of more than ordinary interest. Some slight acquaintance with a few of these wonderful little plants, would render the walk for exercise or pleasure ten times more valuable and remunerative. Who has not noticed so early in summer as some bright, sunny day in June, along the dusty roadside where the blackberry vines creep among the weeds and grass, their leaves powdered beneath with rich golden dust, shaken from little orange colored cups? And many is the enquiry from many a child, or even older person, that I would tell them what such a phenomenon were. The leaves of the barberry bushes too, with their extraneous adornments, when the fruit is tempting men and women, lads and maidens

alike, to the old stone-walls and rocky pastures; the leaves of the quince bushes in the garden; of the thorn bushes in the fields, how strangely distorted by curious forms. The wearied looking and dusty lilac bushes, so dusty at the end of summer that no rain can wash them clean, nor even will, so long as the egg-mould riots on the upper surfaces of their leaves; the crystalline drops of permanent dew glittering in the morning sun and which surmount many a tuft of equally crystal threads in countless numbers, issuing from some rejectamenta or waste matter; these and many, and more beside, often attract attention as we stroll or walk for exercise or pleasure, but are soon forgotten, because nothing is known of them; and who is there to tell? Cunningly, wisely, and full of a secret, hidden meaning, a thousand forms of the lower vegetable life, look up into the faces of pedestrians who, with repressed curiosity, and not quite willingly, tread them under foot. They are leaves of the great folio, marginal notes on the pages of the book of Nature, often and to many, and for a long period to every one, hieroglyphs whose deciphering would repay all the requisite toil. "How thankful I am to you," said a friend, "that you have told me so much about these beautiful, though dry and fragile lichens, which carpet the old pastures; they no longer can taunt me with their presuming pride, that they are something beyond my acquaintance." "The best lectures on botany," said the well-known educator, Geo. B. Emerson, once in conversation, "is after a plan persued by a friend, who in the fields discourses on the structural differences of whatever plant he meets." "Different kinds of plants, enough to occupy your life time, are now under my hand," said Linnæus, a hundred years ago, as the anecdote is told. What would the Swedish savant say now, when on the leaf of the elm alone, more than a dozen species of minute fungi are to be found? In a basket of wet mosses, lay through the night and part of the next day, a large agaric, with a few patches of a white mould attached, which, in that space of time, completely matted by its

rapid growth of intricate fibres, every surrounding object, revealing in the smallest bit of itself the forked branches and spores of a species of Peronospora with its two-formed fruit, any single one of which falling on the living tissue of moss germinated and bore fruit in turn! A few hours dampness and heat will develope the Botrytis and load its slender stalks with grape-like bunches of seed-bearing cells.

With an intention to introduce these little parasitical growths to the attention of the reading and thinking public, to such as would readily attend lectures illustrating such topics, and to make plain and easy, what at first seems so obscure and mysterious, the author commences by bringing forward some of the species most common in England, and explaining by words and by figures their form, structure and occurrence. We have only to change the words a little and designate the fields close to any large town or city of the United States, or at least of New England, to find the same or similar living plants, whose foliage or other parts of them are infested with the same species or with kinds closely allied.

"Amongst the six families into which fungi are divided, is one in which the spores are the principal feature. This family is named *Coniomycetes*, from two Greek words meaning 'dust fungi.' This family includes several smaller groups, termed orders, which are analogous to the natural orders of flowering plants. Without staying to enumerate the characteristics of these orders, we select one in which the spores are enclosed in a distinct *peridium*,* as in our typical plant they are contained within a sort of cup-like excrescence. This order is the Æcidiacei, so-called after Æcidium, the largest and most important of the genera included within this order. The Æcidiacei are always developed on living plants, sometimes on the flowers, fruit, leaf-stalks, or stems, but most commonly on the leaves, occasionally on the upper surface, but generally on the inferior. The different species

* *Peridium*, the covering of the seeds of fungi.

are distributed over a wide area; many are found in Europe and North America; some occur in Asia, Africa, and Australia." (pp. 5, 6.)

The Rev. Dr. M. A. Curtis, in his Catalogue of Plants of North Carolina, published at Raleigh, in 1867, furnishes us with as many as thirty species, to be found on the leaves of as many different living plants. Other lists in different parts of the United States give us still other species infesting other kinds of plants. Thus Schweinitz, in his "Synopsis of North American Fungi," mentions or else describes forty-one distinct species, which grow upon the leaves and other parts of native plants. From these let us select his *Æcidium ranunculacearum*, which attacks the foliage of various kinds of the buttercups, or Ranunculus. This fungus is likewise found in England, and listen to what our author writes about it:

"It is found on several species of Ranunculus, as *R. acris*, *bulbosus*, and *repens*. The leaf is thickened at the spot occupied by the parasite, and generally, without indication, on the opposite surface. Sometimes one spot, at others several, occur on the same leaf. The peridia are densely crowded together, often arranged in a circinate manner, *i. e.*, like a watch-spring. The seeds (spores) are orange, but slightly varying in tint on different species of Ranunculus."

The several species of Ranunculus here cited, though introduced plants, have become common in this country, and serve to enamel with golden blossoms our own meadows and fields. The swelling or excrescence upon the leaves, thus technically called peridium, as we have before noticed, splits at the top into many points or teeth, and renders it a pretty fringed cup filled with the yellow spores. On this account the Æcidiums are termed cluster-cups, the more so, especially when they are arranged in clusters upon the leaf. Of a species which in England infests the leaves of the "Goat's-beard" (*Tragopogon*), we are informed that "the spores in this species are orange, sub-globose, sometimes angular, and

indeed very variable both in size and form, though the majority are comparatively large. Each of these bodies is, doubtless, capable of reproducing its species, and if we compute 2,000 cluster-cups as occurring on each leaf, and we have found half as many more on an ordinary sized leaf, and suppose each cup to contain 250,000 spores, which again is below the actual number, then we have not less than five hundred millions of reproductive bodies on one leaf of the Goat's-beard to furnish a crop of parasites for the plants of the succeeding year. We must reckon by millions, and our figures and faculties fail in appreciating the myriads of spores which compose the orange dust produced upon one infected cluster of plants of Tragopogon. Nor is this all, for our number represents only the actual proto-spores which are contained within the cups; each of these, on germination, may produce not only one but many vegetative spores (sprouting buds), which are exceedingly minute, and individually may be regarded as embryos of a fresh crop of cluster-cups." (pp. 7, 8.)

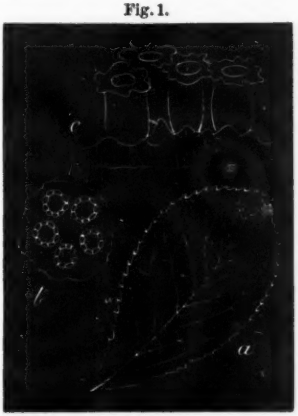
The stems and leaves of the sweet violets, and of the several scentless ones beside, are distorted and ruined by other cluster-cups; the stinging nettle does not escape; the hardy dock, the useful currant, the wild geranium alike, feed with their juices other kinds, and a wide field of observation is offered to the lover of the microscope, to detect and discover other and yet unknown native sorts. However, "let us warn the young student against falling into the error of supposing, because the specific name of the fungus is derived from the plant it infests, that therefore the species differs with that of the plant, and that as a rule he may anticipate meeting with a distinct species of fungus on every distinct species of plant, or that the parasite which he encounters on the living leaves of any one plant is *necessarily* specifically distinct from those found on all other plants. The mycologist* will look to the specific differences in the parasite with-

* Mycologist, one who exclusively studies fungi.

out regard to the identity or distinctness of the plant upon which it is a parasite." (p. 6.)

It is an old and erroneous opinion which some of our farmers yet entertain, and which they have received by tradition from their ancestry, who brought it with them from the "old country," that the cluster-cups on the leaves of the barberry were capable of producing the blight and mildew upon grain, and that as an exemption from, or security against, such a fate, every barberry-bush should be effectually exterminated from the grain-fields, if, by careless husbandry or purposely for its fruit, it should be found bordering them. "This opinion," says our author, "even received the support of Sir Joseph Banks, but no fungi can be much more distinct than those found on grain crops, and this species on the leaves of the barberry.* In this instance the cups are elongated and cylindrical, and the spots on the upper surface of the leaf are reddish, bright, and distinct; the teeth on the edge of the cup are white and brittle, and the orange spores copious." (Fig. 1; *a*, leaf of barberry, with cluster-cups, *Æcidium berberidis; b*, a portion magnified; *c*, the same seen sidewise).

Fig. 1.



Very singular and curious clusters of excresences occur on the leaves of the apple tree, pear tree, and mountain-ash bush, and are very prominent on the leaves of the quince tree, and especially of the wild apple tree of the West, consisting of large peridia, pointed at the tops, and so swollen below as to bear a rude resemblance to urns, the edges split into

*This fungus and *Puccinia graminis* have been recently determined by Professor Œrsted to be one and the same plant. See Dr. Lütken's Review in the preceding number of the NATURALIST.

long and contorted threads. They are species of Rœstelia, the *R. lacerata* (Fig. 2; *a*, natural size, living on the leaves and fruit of the hawthorn; *b*, a portion magnified), *cancellata*, *mali*, *cornuta*, and of the *Centridium cydonia*, the spores of which are of a light orange color. The leaves of the pine and fir are sometimes attacked by the *Peridermium*, which in two species alters the foliage and spoils the effect of the branches. "In this genus the peridium bursts irregularly, and does not form cups or horns or fringed vessels." The *P. pini* has been frequently noticed in this country. The common houseleek is, in England, attacked by a parasitical fungus of this family, which burrows in the pulpy tissue of its thick and succulent leaves, and hence called *Endophyllum;* but I can find no notice of its occurrence with us. "We have derived much pleasure," says Mr. Cooke, "in viewing the astonishment and delight exhibited by friends to whom we have personally communicated specimens of the little fungi we have enumerated for examination under the microscope; and we recommend with confidence this group of parasitic plants, unfortunately so little known, as well worthy the attention of all who are interested in the minute aspects of nature, and who can recognize the hand

Fig. 2

> 'That sets a sun amidst the firmament,
> Or moulds a dewdrop, and lights up its gem.'" (p. 21.)

To which we can but add our hearty assent, and only wish that investigations and studies so prolific of gratification were more universal, especially among the young.

The spores of these smaller fungi have been spoken of as a sort of seeds by which the plants to which they belong are propagated. This, as we shall now see, is not strictly true,

and several novel and interesting points for consideration and even for enquiry arise. If we should place some of the yellow dust, which fills the cup-shaped peridia in a drop of water, and prevent its evaporation by covering it with a bell-glass, a tumbler or wine-glass would do as well, we should find, in a few hours, that each particle of the dust had swollen, and bursting at some point, had given out a blunt thread, at the apex of which, it is crowned with delicate curved appendages, which soon become connected by lateral threads, thus forming a kind of latticed net-work, and from the sides of these filaments little oblong cells sprout, which in turn germinate and reproduce the plant. For this highly interesting discovery we are indebted to the Rev. M. J. Berkeley of England, and a particular and extended account of which may be found in the London Journal of Horticulture, vol. 2, p. 107. Those of our readers, who are familiar with the early stages of the ferns can trace a striking analogy in the process.

In many of the smaller fungi, the first condition of the germinating spore, viz.: the cluster of curved and delicate appendages surmounting a thread, is present in another form, and constitutes what is termed the *Spermogone*,* often in the shape of a minute dot near the peridium and sometimes on the opposite surface of the leaf, and in fact a conceptacle or blister filled with threads, and throwing off from the apices the curved bodies, called *spermatia*, which escaped through an orifice provided for the purpose. Before the nature and office of these singular objects were known, spermogones were mistaken for distinct kinds of fungi, and many diverse species were described. They are, however, not wholly confined to the fungi, but even the lichens are furnished with similar ones. The size of the largest spermatia, those of the *Peridermium pini*, "have a length equal to $\frac{1}{52\frac{1}{000}}$ of an inch, but their width seldom exceed $\frac{1}{1\,0\,0\frac{1}{0\,0\,0}}$ of an inch,

* *Spermogones*,— pustules and depressions like pockets, containing *Spermatia* or germinating filaments.

whilst on others their length does not exceed the width of those just named." (p. 25.)

The evident effort of nature, then, in this process, is to produce an ultimate condition of fungal life, which shall be sure to continue indefinitely the presence of the parasites upon the leaves and other parts of the higher plants. And this is done by the *mycelium*,* a system of the most subtle threads which can enter the tissues by attacking the seed when sown, and whose persistence of vitality enables it to endure the most trying circumstances unharmed. So vitalized indeed is the mycelium, that any fragment of it will vegetate and grow after long periods of desiccation. And its luxuriance of growth is in nowise dependent on any higher development, such as, were it the stems and leaves of a flowering plant, would sooner or later push forth blossoms and fruit.

This vitality is taken advantage of in the cultivation of the edible fungi, such as the mushroom for example, where lumps of dried earth, permeated by the mycelium or "spawn," as it is technically called, are planted in prepared soil, and a profitable crop realized. It is also familiar to cultivators, that fruit trees and ornamental trees often languish and die, owing to their roots reaching spots deep in the ground where decayed wood, filled with the "spawn" of some destructive fungus exists. Fortunately the awakening to active life, and to injurious growth, seems to depend on causes which do not always exist, such as atmospherical and similar conditions, else there were no chance of security from these annual scourges of agricultural industry. Fungi of every kind are therefore regarded as meteorological phenomena; like a few of the higher plants, which appear at wide intervals, and then, sparsely.—*To be concluded.*

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* *Mycelium*, the fibrous portion of fungi, which grows underground or in the tissues of the plants upon which they are growing, and sometimes under the bark of living or dead plants.

BIRD'S-EYE VIEWS.

BY DR. ELLIOTT COUES, U. S. A.

(Concluded from page 513.)

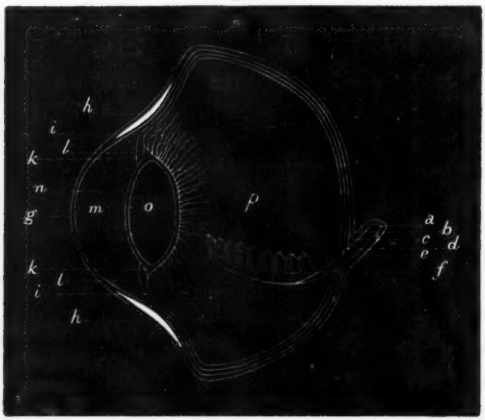
In our last "View" we saw all the appendages of a bird's eye; and now we come to look at the eye itself. "Eye-ball" and "globe of the eye" are very convenient terms, constantly in our mouths; but they are not strictly accurate ones. Probably there are no perfectly spherical eyes. In our own species, the eye is made up of a segment of a large sphere, representing about five-sixths of its superficies; the other sixth is a smaller segment of a small sphere, joined in front to the former. Most mammal's eyes are not very different in this respect from our own. Bird's eyes are much further removed from perfect sphericity. The greater part of the ball is saucer-shaped,—almost discoidal; and there is a very convex prominence, more or less hemispherical in shape, in front. The whole eye may be likened to an acorn of one of those oaks that bear a fruit with a heavy broad shallow cup, and short blunt kernel, or to a thick old-fashioned watch with a very convex crystal.

This shape is one of the distinguishing characters of a bird's eye: the figure (Fig. 2) will give a better idea of it than any description. It represents a vertical section through the middle of an eye in profile, and shows nearly all the structures and organs that can be demonstrated in the ball. Before making use of it, however, the reader must be reminded of the two following points: First, the distinctness of the several membranes forming the ball is greatly exaggerated; for otherwise the different membranes could not be represented as such. Secondly, the ciliary processes, optic nerve, and marsupium, do not fall wholly within the line of a vertical section; they lie curving obliquely against the inside of the walls of the hollow spheroid. But no idea whatever

could be gained of them, were they merely represented at the isolated points where they cross the vertical plane; and they are therefore introduced somewhat artificially. The sacrifice of theoretical accuracy is more than compensated for by increased perspicuity.

Recollecting that the "eyeball"—as we shall continue to call it for convenience sake—is filled with fluid that presses equally in every direction, we cannot at first make out how its peculiar shape is maintained. But the reason why the ball does not assume a spherical shape really is plain enough when we come to dissect its coats. They are partly *bony*. They are splinted, as it were, with the bones (*h*, *h*) that are packed alongside each other all around the circumference of one part of the ball.

Fig. 2.*



The large discoidal segment of a bird's eye is mostly made up of a membrane called the *sclerotic*, from its hard, dense structure. It is a thick, strong, tough membrane, of a glistening livid, or grayish blue color. Three sclerotic coats or layers, differing from each other a little in texture, may be demonstrated by careful dissection, though on super-

*Fig. 2. Vertical antero-posterior section through middle of eyeball. *a*, optic nerve; *b*, sclerotic, outer coat; *c*, sclerotic, middle and inner coats; *d*, choroid; *e*, hyaloid; *f*, marsupium; *g*, cornea; *h*, *h*, bony plates between layers of sclerotic; *i*, *i*, corrugations of choroid, forming the ciliary processes; *k*, *k*, canal of Petit; *l*, *l*, iris; *m*, anterior chamber; *n*, capsule of lens; *o*, lens; *p*, posterior chamber. Neither the retina, nor the peculiar sheathing of the optic nerve, is shown. The nerve, the marsupium, and the ciliary processes, do not wholly fall within a vertical section through the middle of the eye, and cannot be represented in this figure except artificially.

ficial examination the sclerotic presents itself as a single homogeneous tissue. In the figure (*b*) is the outer coat, and (*c*) the middle and inner ones combined. The osseous plates just mentioned lie between the outer and middle sclerotic coats, anterior to the greatest circumference of the eyeball, and nearly or quite extend from the rim of the disk to the edge of the central anterior transparent part of the ball—the *cornea*. They are fifteen or twenty in number, of an oblong, quadrate shape, broader behind, tapering toward the cornea, and so disposed as to form a complete bony circlet around the latter. Collectively, they enjoy some little motion, their anterior margins advancing and receding with the varying convexity of the cornea; but they cannot individually wabble, being firmly bound to each other by the continuation of the sclerotic coats between them.

The *cornea* (*g*) is the thin transparent membrane in front that the bird looks through. It forms the anterior part of the wall of the eye, and is, in one sense, a continuation of the sclerotic; but its texture is very different from that of the latter. It is the prominent convex part of the eye,—the hemisphere of the small globe that has been already mentioned. Its structure offers nothing peculiar, being essentially the same as in mammals; but its shape is remarkable. Always very convex, it is sometimes still more protuberant, being elongated into a sort of cylinder, with a hemispherical top. This tubulation is very great, for example, in the nocturnal birds of prey (Owls, *Strigidæ*). The alteration of shape that the cornea is capable of is next most singular, as will be explained when we come to speak of the powers of the eye as a whole. It is sufficient here to bear in mind the unusual shape of the cornea, and its power of increasing and diminishing its convexity.

The sclerotic coat is lined inside with a membrane of very different tissue—the *choroid* (*d*). While the former is tough and fibrous, with comparatively few blood-vessels, the latter is more loosely woven of cellular tissue, replete with

interlacing blood-vessels, and painted pitch-black all over. The deposit of pigmentary or black coloring matter is very heavy, and serves to absorb those rays of light not needed in vision. The choroid membrane lines all the inside of the eye as far forward as the edges of the bony plates, where it splits into two layers. The *inner* of these turns away from the wall of the ball, towards the axis or middle line of the eye, and in so doing becomes gathered in plicæ, or folds, much as the top of a bag is wrinkled by pulling the string. These radiating folds come from all around, to collect together upon the rim of the crystalline lens (*o*), or rather of the delicate capsule (*n*) that encloses the lens, and adhere there. Their terminations form what are called the *ciliary processes* (*i*, *i*). The *outer* layer also curls away from the sclerotic, and starts to go transversely across the eyeball, but ends at once in the iris.

The *iris* (*l*, *l*) is the most exquisitely beautiful structure in a bird's eye. It is the many-colored curtain that hangs vertically between the two apartments of the eye. It is the highly ornamented framework of the window of the eye, uniting the offices of sash and blind. The crystalline lens is suspended in the round hole punched in the centre of the iris. Viewed in front, from the outside, the iris appears as a colored circular band around the pupil. It seems to lie directly on the surface. But this is not so, for the cornea and its humors are between us and it. It is like the dial-plate of a watch, that we look straight at without noticing the crystal that is interposed. The central aperture through which come the shafts that the hands are fastened to, may be likened to the pupil. Everybody knows what the "pupil" is, in a vague way. It is the round black spot inside the colored rim of the iris; but few understand what the spot is. The difficulty is, that the pupil is regarded as a material thing—a tissue, structure, or organ—when it is not. It is the absence of matter. The round black spot called the pupil is not a "thing;" it is a hole in a thing,—the hole in

the iris through which we look (the transparent crystalline lens offering no obstruction to our view) directly into and across the posterior chamber of the eye, and see the black pigment on the choroid behind. Albino animals have pink eyes, because the coloring matter of the choroid is wanting, and the hue of the blood in its numerous fine vessels appears. And even if we look into a normal eye with the ophthalmoscope, we have a reddish instead of a black field of vision. The pupil takes its name from a very pretty conceit. On looking straight at it, our image is reflected to us, only so diminished that we are transformed into pigmies. We find an expression of the same thing in other languages beside our own. In Spanish, the liliputian photograph is called "niñacita del ojo;" which means "little eye-baby."

But to return from this digression to the iris, which has been all the time nervously quivering at our neglect. It is essentially similar in structure to the choroid, being a delicate tissue of fibres and vessels interlacing in every direction; but it has, in addition, a structure that is regarded as muscular. The iridian muscles are mainly disposed in two ways; there is a circular set running around, and a radiating set that pass across from the inner to the outer border. By means of these, which are mutually antagonistic, the iris is contracted and expanded, and its aperture—the pupil—correspondingly varied in size. In mammals, the movement of the iris appears to be automatic, and to depend upon the stimulus of light; and they are not so great, as a general rule, as in birds. In the latter, they are extraordinary, not only in degree, but in the rapidity with which they may be executed. Although birds' irides respond primarily, and perhaps chiefly, to the action of light, their movements seem to be partly, at least, subject to the will, and therefore voluntary. These conditions of mobility in the iris relate directly to such exigencies as, for examples, the owl meets with in the daytime, or the eagle encounters in his flight towards the sun.

The iris of birds is copiously supplied with coloring matter; the tints vary with different species, and are often extremely brilliant. Some shade of brown is, perhaps, the commonest color. Yellow is very common; red is often seen; blue and green are more rarely met with. The eyes of Cormorants are of the latter color. Sometimes the iris is blackish, or black, like the choroid; and it is frequently pure white, as in the instance of one of our common birds, the White-eyed Greenlet (*Vireo Novæboracensis*).

The *crystalline lens* (*o*) is a transparent bi-convex disk, just like a common magnifying glass. It apparently hangs on the iris like a looking-glass in its frame, but is really set a little further back. In birds, it is rather flatter, especially behind, and also softer in consistency, than in some other classes. It is enclosed in a very delicate transparent membrane, its *capsule* (*n*), which is in turn set in between two layers of a membrane, called "hyaline," to be presently described. Where the two hyaloid layers separate around the rim of the capsule, to form its case, a small space is left, that makes a circular tube all around, called the *canal of Petit* (*k*, *k*). The lens is stationary as far as the axis of vision is concerned; but is capable of being moved a little forwards and backwards, by the pressure of the humors of the eye, which is produced by the coöperative action of certain muscular and vascular structures, as we shall see before we get through. This movement adjusts the focus for vision, exactly as it is adjusted in a telescope, for instance, by lengthening or shortening the tube.

We can understand, now, that the eyeball is divided into two compartments, or "chambers," as they are called, by the inward reflection of the two choroid coats, the hyaloid, the iris, and the lens, which together form a vertical wall. Both of these chambers are filled with fluid, of different density and consistence in each. That in the anterior division is thin and watery, and therefore called the "aqueous humor;" that in the posterior one is more dense and glassy, and is for

this reason known as the "vitreous humor." There is much less aqueous than vitreous, because the anterior chamber is much the smaller of the two; but birds have more of the former, compared with the quantity of the latter, than mammals, because the size and convexity of the cornea is relatively greater. The aqueous humor is enclosed in a very delicate simple membrane, that cannot be demonstrated without difficulty. The vitreous is contained in a more palpable, as well as complex membrane—the *hyaloid* (*e*) —which, besides lining the interior of all the back part of the eye, and enclosing the lens as already described, sends thin laminæ, or layers, all through the vitreous humor, forming partitions that serve to steady the glassy waters.

We may next turn our attention to the optic nerve (*a*) that presents itself in the all-important character of the "soul of the eye." It has many peculiarities in birds; among them one that constitutes the most characteristic feature of the eye of these creatures. In mammals, as a general rule, the nerve is a smooth cylinder that comes straight to the sclerotic, near the middle behind, penetrates straight through the coats of the eyeball, and then spreads out on all sides to form a disk on the inside of the back of the eye. This circular saucer-like expansion is the *retina*—the sensitive nervous plate, or mirror, upon which images of things viewed are photographed, to be transmitted along the nerve to the brain, and there "perceived." Suppose the optic nerve to be an umbrella-handle, the retina would then be the umbrella, blown inside out by the wind. In birds the nerve acts very differently. In the first place, though it is cylindrical, it is not smooth; it has lengthwise folds and ridges. It is like a fluted column. It comes obliquely towards the eye, which it strikes at a point eccentric from the axis of the ball; and then, instead of at once piercing all the sclerotic coats, and expanding into a concavo-convex disk, it tapers gradually to a fine point. This elongated extremity runs still obliquely, downwards and forwards, in a deep groove in the sclerotic, that

would be a perfect sheath were it not split lengthwise. Through this slit, and through a corresponding one in the choroid membrane, a fold or fluting of the nerve rises up, finally attaining the inside of the eye. The retina spreads out from all along the sides and extremities of this fold.

Only one other structure remains to be described—the crowning anatomical peculiarity of a bird's eye. This is the *marsupium*, or *pecten* (*f*). Though attached at one end to the optic nerve, it is not a part of the nerve at all, nor composed of nervous tissue. It is a very vascular membrane, most like the choroid in texture, and likewise painted black. When fully extended, it is seen to be of an oblong or rectangular shape; when lying naturally *in situ*, it is much drawn up, and its sides are transversely wrinkled or plicated. It is suspended in the vitreous humor, running obliquely forwards a great part, or the whole of the way, from the end of the optic nerve to the crystalline lens. In the former case it appears attached anteriorly to some of the laminæ of the hyaline; in the latter to the capsule of the lens. Behind, it is always fastened to the optic nerve. It is called the "marsupium," because it does not in the least resemble a purse or pouch; and the "pecten" because it does not look anything like a comb. Anatomists have not agreed upon what to consider as the function of this organ, nor upon the *quo modo* of its operation. Some have thought that it absorbs the superfluous rays of light that must often enter the eye, because it is blackened with pigment. One who adhered to this belief went further, considering that, from its eccentric position, it absorbs mainly oblique rays, which being taken away, objects placed in direct rays may be more plainly perceived. Some, again, have regarded it, in consequence of its vascular structure, as the organ that secretes, or aids the choroid in secreting the vitreous humor; an additional apparatus being needed for the elaboration of this fluid, because it is used up so fast in the rapid and incessant movements of the eye. But the theory now generally ac-

cepted differs from all of these hypotheses, and makes out the marsupium to be an "erectile" organ. Although no muscular fibres have been shown to exist in it, yet it is probably capable of expansion and contraction much as if it were muscular. It is a highly vascular structure, as we have seen; and the increased or diminished turgidity of its numerous blood-vessels* would, of course, alter its dimensions. If it occupies a variable space in the vitreous humor, it must affect the position of the lens, and by this means change the focus of the eye. This seems to be the most satisfactory explanation, both of the design of the marsupium, and of the mode in which its design is carried out. In this view, the organ is marshalled with several others that we know contribute to the greatest physiological phenomenon of a bird's eye,—the rapid adjustment of focus.

As anatomists, we have examined the structure, and position, and appearance of the organs that make up a bird's eye. But our study would be to little purpose if it ended here with an inspection of dead tissues. We have seen some curious things that, perhaps, have afforded us gratification, which is well enough as far as it goes; but curiosity is only laudable when, disdaining amusement as an ulterior object, it is contented only with a higher aim,—instruction. We must look, as physiologists, at the operations of the eye, and the mode in which its functions are conducted and accomplished. All that has gone before is merely to prepare us to question intelligently the structures we have examined, and find out how they work.

Eyes are made to see with, of course; but *how* we see with our eyes nobody knows. No one can tell us *how* an

*It is not apparent, at first sight, whence the marsupium gets its numerous vessels, since it is not attached at all to the vascular membrane of the eye,—the choroid. Professor Owen remarks on this subject: "Branches of the ophthalmic artery, distinct from the vessels of the choroid, and homologous with the *arteria centralis retinæ*, enter the eye between the laminæ of the retina, along the whole extent of the oblique slit (in the sclerotic and choroid), and immediately penetrate the folds of the marsupial membrane, upon which they form delicate ramifications." (Anatomy of Vertebrates, Vol. II, p. 139.)

image formed on the retina is conveyed to the brain, and transformed into a mental perception, capable of being thought about. This is inscrutable; it is here the part of wisdom to confess ignorance, and acknowledge bounds that human reason cannot overstep. Nor have we need here to go into the general optical laws applicable to vision; they are well known, and moreover relate no more to a bird's eye than to that of any other animal. What we want is to find out the *meaning* of the structural peculiarities by which a bird's eye differs from other eyes. What is the reason and the purpose of the three eyelids? of the shape of the ball? of the very abundant aqueous humor? of the movable lens? of the marsupium? the tapering nerve? What special relation do these and other features bear to the sense of sight in birds? In other words, why must a bird have just this sort of an eye to be able to see perfectly? Some of these questions can be satisfactorily answered; others not. Some we have already replied to as they arose in our mind involuntarily during our dissection. Thus the third lid gives a subdued light, without excluding light altogether; and also protects the eye, which could not be otherwise protected without closure of its outer opaque lids, and loss of sight altogether. The very convex and highly refractive cornea doubtless has some relation to a bird's ability to see straight ahead, though its eyes look directly sidewise.

Perhaps no reason has been assigned for the singular course and termination of the optic nerve. These have possibly no special optical relations; the cause may lie simply in the relative situations of the brain and eye, which are such, that the nerve would have to change its course abruptly to pierce directly through the sclerotic. We cannot see through a crooked tube, any more than we can shoot round a corner. Nerves are the railroads of thought. A train of thought might run off the track if the curves and grades were not easy. I believe that we find comparatively few instances of abrupt angles in the course of nerves. If

we consider the marsupium as an erectile organ, we are not content to understand how it erects itself, and what it accomplishes by erection; we want to know why it is necessary or desirable that it should do what it does.

Putting together all that we do know of the operation of a bird's eye; and from this inferring some things that we do not know, we are irresistably led to the conclusion, that all the essential peculiarities of a bird's eye conspire to produce what we just now called its greatest physiological phenomenon—*instantaneous unerring adjustment of focus.*

Study of the habits of birds makes the necessity of some such faculty as this as evident as the fact of its existence. This admirable provision relates in the most direct manner possible to the rapid movements of birds in the air. As they dash onward in their airy course, the eye accommodates itself, if not with the speed of thought, at least with the speed of flight, to ever-varying distances, and surrounding objects, be they far or near, all alike rush into focus. With our own eyes, we see at once a book before us, and a large object in the distance. Push the book away by degrees; the letters run into words, words into lines, lines into paragraphs, paragraphs into a solid page of dark, surrounded by a white border; then the edges of the cover gain a film, the outlines soften, the thing becomes a spot, and finally disappears. If a bird were in our place, it would still see letters long after they had disappeared from our view. Its eye would change in shape, and the structures within alter in position, as the book moved off, slowly, gradually, constantly, till the limit of its power was reached; and this limit it need not be said, far exceeds ours. Walk towards the large object now indistinct in the distance. How long we are in approaching it: how very slowly it takes form as we advance, until it stands forth clearly in view! Let a wild duck fly at the rate of ninety miles an hour, towards the same object. How rapid must be the adjustment of its eyes compared with ours! But these are among the

moderate exhibitions of a bird's visual powers. Watch a Humming-bird: it darts away so swiftly that our eyes cannot follow it, and settles, light as a feather, upon a twig. We do not know how far off it discovered the twig; but, at whatever distance it was first brought into focus, the Humming-bird's eye adjusted itself during the fraction of a second that the bird was flying; and the twig was in focus at the instant the bird alighted upon it. Were we to move with the same velocity, our eyes would fail us; they could not accommodate themselves quick enough. See a Sparrow-hawk dash through a thick clump of bushes in headlong pursuit of its prey. Think you it rushes blindly, taking the chances of escaping the close-set obstacles in its way? It sees each stake and branch as it comes on, and avoids them all. Had we a Sparrow-hawk's power of flight we could not follow him for want of his powers of vision.

Observe an eagle circling in the air. He is soaring aloft higher and higher, till he becomes, to us, but a speck against the blue expanse. As he turns towards the sun, a signal is made, and quick as thought obedient servants obey the summons. The nictitating membrane, asleep in its corner, starts up and spreads over the cornea in an instant: the quivering iris, ever on the alert, enfolds the crystalline lens in a close embrace; and the tranquility of the retina is undisturbed. As he turns away, the enemy no longer harasses, and the guards retire. Now the great bird prepares to scan the ground below. His eye lies loosely in its socket; the muscles relax; the marsupium lies torpid; the lens falls back; the cornea sinks; the waters retire; all are quiet. The retina alone glows and thrills with excitement. He is now far-sighted; he descries an object on the earth smaller than himself, even from this vast height; and makes ready for the fearful plunge. He poises a moment; the word is given; as trusty sailors to their posts to save the good ship in a storm, so rush the sentinels of the eye into action. Down he swoops; the muscles tauten, and the waters rush forward;

the cornea feels the pressure within, and starts out; the marsupium stands erect, swelling and bristling all over, and the lens leaps forward, while the iris flaunts the flag of battle. Guided by such an instrument as this, the bird comes down with unerring aim upon his quarry; he seizes it in his talons; and now, become near sighted, well can he see to perform the bloody work before him.

There is, perhaps, as much to be seen in a view of a bird's eye, as ever lies within the bounds of a "bird's-eye view."

HABITS OF THE BURROWING OWL OF CALIFORNIA.

BY DR. C. S. CANFIELD.*

I WISH to state a few facts about the Burrowing Owl (*Athene cunicularia* Molina) that lives in California. I had almost constantly for four years opportunities of observing the habits of this little owl, which is really one of the most notable features in the natural history of California. A colony of these owls lived within one hundred yards of my cabin while I passed a frontier life; and they were very common everywhere in that vicinity. I have seen them every day for years, hundreds and perhaps thousands of them in all. Where I have seen them, they always live in the deserted or unoccupied burrows of the Ground Squirrel (*Spermophilus Beecheyi*). I came to the conclusion that they were able to drive out the Spermophiles from their habitations, but I am not certain of the fact. It is true that there were, in that region, always a large number of unoccupied burrows wherever there was a colony of Spermophiles; so that there was no lack of unoccupied habitations for the owls to take possession of. But I have noticed that wherever there was a large number of the owls, very few or no Sper-

*Communicated in a letter to the Smithsonian Institution, and forwarded by the Secretary for publication.

mophiles lived. *One* or *two* owls would occasionally be seen among a colony of Spermophiles, but they never appeared to live in the same hole or burrow with the squirrel; and I have never seen a squirrel enter a burrow that was occupied by owls, however much tempted by fear he might be to enter the first hole he should come to. True, the Spermophile never likes to enter any burrow but his own, and will run past any number of inviting entrances in order that he may at last hide himself in his own domicile. But aside from this, I believe that the squirrels are afraid of the owls, and do not dare to intrude upon them. The notion that the Athene digs its own burrow appears to me apocryphal and unreasonable. I have never seen any evidence of it. Negative evidence proves nothing; but yet the absence of facts is strong presumption against their existence, and it would be strange that I should never have seen any evidences of their digging powers if they have any. After a shower of rain, one sees fresh earth thrown out around the mouths of the burrows of the Spermophiles, but never anything of the kind around the burrows of the owls. They are not constituted for digging, and there is no necessity for it; they can always find any number of holes ready-made for them. That they live in peace and amity with the rattlesnake, I believe to be another error and stretch of the imagination. Rattlesnakes are very abundant where I lived, and I killed one or two almost every time that I rode a mile or more from the house, yet I never saw a rattlesnake near a squirrel's hole but once, and that hole was a deserted one. I once found a large rattlesnake swallowing a squirrel (*Spermophilus Beecheyi*) that it had caught, in the centre of a colony of squirrels, but several yards distant from any "squirrel-hole."

I once took pains to dig out a nest of the *Athene cunicularia*. I found that the burrow was about four feet long, and the nest was only about two feet from the surface of the ground. The nest was made in a cavity in the ground, of about a foot in diameter, well filled in with dry soft horse-

dung, bits of an old blanket, and fur of a Coyoté (*Canis latrans*) that I had killed a few days before. One of the parent birds (male or female?) was in the nest, and I captured it. It had no intention of leaving the nest, even when entirely uncovered by the shovel, and exposed to the open air. It fought bravely with beak and claws. I found *seven* young ones, perhaps eight or ten days old, well covered with down, but without any feathers. The whole nest, as well as the birds (old and young), swarmed with fleas. It was the filthiest nest that I ever saw. In the passage leading to the nest there were small scraps of dead animals; such as pieces of the skin of the antelope, half dried and half putrified, the skin of the coyoté, etc.; and near the nest were the remains of a snake that I had killed two days before, a large *Coluber?* two feet long. The birds had begun at the snake's head, and had picked off the flesh clean from the vertebræ and ribs for about one-half of its length; the other half of the snake was entire. The material on which the young birds nested was at least three inches in depth. I do not remember the time of the year.

The Burrowing Owls do not migrate. Where I lived they were as numerous in winter as in summer. Perhaps in low, flat plains, that are deluged or inundated by water in the winter, the little owl is obliged to have a far drier location, but I have never seen any such migration. They always remain in or near their burrows through the day, never leaving them to go any distance except when disturbed, when they make a short crooked flight to some other hole near by, and when driven from this last one return to the first again. When the sun sets they sally forth to hunt for food, etc., and are all night on the wing. I had seen them and heard them at all times of the night and early in the morning. They are not strictly nocturnal, for they do not remain in their nests or burrows all day, but their habits, in this respect, are about the same as those of the other owls, as *Strix pratincola*, *Nyctea nivea*, etc., or of the domestic cat.

There are very few birds that carry more rubbish into the nest than the *Athene;* and even the Vultures are not much more filthy. I am satisfied that the *Athene canicularia* lays a larger number of eggs than is attributed to it in Dr. Brewer's work. I have frequently seen, late in the season, six, seven or eight, young birds standing around the mouth of a burrow, isolated from others in such a manner that I could not suppose that they belonged to two or more families.

A CHAPTER ON FLIES.

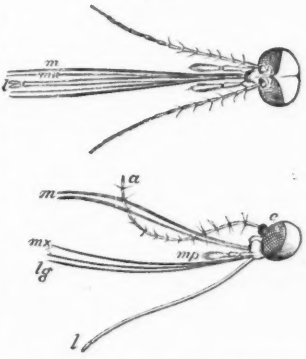
BY A. S. PACKARD, JR.

THE subject of flies becomes of vast moment to a Pharaoh, whose ears are dinned with the buzz of myriad winged plagues, mingled with angry cries from malcontent and fly-pestered subjects; or to the summer traveller in northern lands, where they oppose a stronger barrier to his explorations than the loftiest mountains or the broadest streams; or to the African pioneer, whose cattle, his main dependence, are stung to death by the Tsetze fly; or the farmer whose eyes on the evening of a warm spring day, after a placid contemplation of his growing acres of wheat-blades, suddenly detects in dismay clouds of the Wheat-midge and Hessian-fly hovering over their swaying tops. The subject, indeed, has in such cases, a national importance, and a few words regarding the main points in the habits of flies—how they grow, how they do not grow (after assuming the winged state), and how they bite; for who has not endured the smart and sting of these dipterous Shylocks, that almost torment us out of our existence while taking their drop of our heart's blood—may be welcome to the readers of the NATURALIST.

The Mosquito will be our first choice. As she leaps off

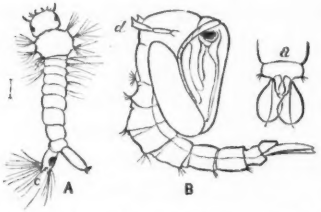
from her light bark, the cast chrysalis skin of her early life beneath the waters, and sails away in the sunlight, her velvety wings fringed with silken hairs, and her neatly bodiced trim figure (though her nose is rather salient, considering that it is half as long as her entire body), present a beauty and grace of form and movement quite unsurpassed by her dipterous allies. She draws near and softly alights upon the hand of the charmed beholder, subdues her trumpeting notes, folds her wings noiselessly upon her back, daintily sets down one foot after the other, and with an eagerness chastened by the most refined delicacy for the feelings of her victim, and with the air of Velpeau redivivus drives through crushed and bleeding capillaries, shrinking nerves and injured tissues, a many-bladed lancet of marvellous fineness, of wonderful complexity and fitness. While engorging herself with our blood, we will examine under the microscope the mosquito's mouth. The head (Fig. 1) is rounded, with the two eyes occupying a large part of the surface, and nearly meeting on the top of the head. Out of the forehead, so to speak, grow the long, delicate, hairy antennæ (*a*), and just below arises the long beak which consists of the bristle-like maxillæ (*mx*, with their palpi, *mp*) and mandibles (*m*), and the single hair-like labrum, all which five bristle-like organs are laid in the hollowed labium (*l*). Thus massed into a single awl-like beak, the mosquito, without any apparent effort, thrusts them into the flesh, and by aid of the sucker-like expansion of the end of the labium, draws in the blood through the channel formed by the five bristles and their sheath. Her hind-body may be seen filling with the red blood, until it cries quits, and the insect with-

Fig. 1.



draws its sting and flies sluggishly away. In a moment the wounded parts itch slightly, though a very robust person may not notice the irritation, or a more delicate individual if asleep; though if weakened by disease, or if stung in a highly vascular and sensitive part, such as the eyelid, the bites become really a serious matter. Multiply the mosquitoes a thousand fold, and one flees their attacks and avoids their haunts as he would a nest of hornets. Early in spring the larva (Fig. 2, A) of the mosquito may be found in pools and ditches. It remains at the bottom feeding upon decaying matter, thus acting as a scavenger, and in this state doing great benefit in clearing swamps of miasms, until it rises to the surface for air, which it inhales through a single respiratory tube (*c*) situated near the tail. When about to transform into the pupa state, it contracts and enlarges anteriorly near the middle, the larval skin is thrown off, and the insect appears in quite a different form (Fig. 2, B; for which we are indebted to Mr. E. Burgess). The head and thorax are massed together, the rudiments of the mouth-parts and of the wings and legs being folded upon the breast, and there are two breathing tubes (*d*) situated upon the back instead of the tail, which ends in two broad paddles (*a*); so that it comes to the surface head foremost instead of tail first, a position according better with its increased age and experience in pond life. In a few days the pupa skin is cast, the insect, availing itself of its old habiliments as a raft upon which to float while its body is drying, grows lighter, and its wings expand for its marriage flight. The males are beautiful, both physically and morally, as they do not bite; their manners are more retiring than those of their stronger minded partners, as they rarely enter our dwellings, and live unnoticed in the woods. They may be easily

Fig. 2.



distinguished from the females by their long maxillary palpi, and their thick, bushy, feathered antennæ. The female lays her elongated oval eggs in a boat-shaped mass, which floats on the water. A mosquito lives three or four weeks in the water before changing to the adult or winged stage. Just how many days they live in the latter state we do not know.

Our readers will understand then, that all flies, like our mosquito for example, grow while in the larva and pupa state, *and after they acquire wings do not grow*, so that the small midges are not young mosquitoes, but the adult winged forms of an entirely different species and genus of fly, and the myriads of small flies, commonly supposed to be the young of larger flies, are adult forms belonging to different species of different genera, and perhaps of different families of the suborder of Diptera. The typical species of the genus Culex, to which the mosquito belongs, is *Culex pipiens*, described by Linnæus, and there are already over thirty North American species of this genus described in various works. The habits of a fly allied to the mosquito are given, with illustrations, in the July number of the NATURALIST, which farther elucidates the habits of these insects. The Hessian-fly and Wheat-midge are briefly referred to and figured on page 163, so that we pass over these to consider another pest of our forests and prairies.

The Black fly is even a more formidable pest than the mosquito. In the northern, subarctic regions, it opposes a barrier against travel. The Labrador fisherman spends his summer on the seashore, scarcely daring to penetrate the interior on account of the swarms of these flies. During a summer residence on this coast, we sailed up the Esquimaux river for six or eight miles, spending a few hours at a house situated on the bank. The day was warm and but little wind blowing, and the swarms of black flies were absolutely terrific. In vain we frantically waved our net among them, allured by some rare moth; after making a few desperate charges in the face of the thronging pests, we had to retire to the

house, where the windows actually swarmed with them; but here they would fly in our face, crawl under one's clothes, where they even remain and bite in the night. The children in the house were sickly and worn by their unceasing torments; and the shaggy Newfoundland dogs, whose thick coats would seem to be proof against their bites, ran from their shelter beneath the bench and dashed into the river, their only retreat. In cloudy weather, unlike the mosquito, the black fly disappears, only flying when the sun shines. The bite of the black fly is often severe, the creature leaving a large clot of blood to mark the scene of its surgical triumphs. Mr. E. T. Cox, of New Harmony, Indiana, has sent us specimens of a much larger fly, which Baron Osten Sacken refers to this genus, which is called on the prairies, the Buffalo Gnat, where it is said to bite horses to death. Westwood states that an allied fly (*Rhagis Columbaschensis* Fabr.) is one of the greatest scourges of man and beast in Hungary, where it has been known to kill cattle.

The *Simulium molestum* (Pl. 12, fig. 1, enlarged), as the black fly is called, lives during the larva state in the water. The larva of a Labrador species (Pl. 12, fig. 2, enlarged) which we found, is about a quarter of an inch long, and of the appearance here indicated. The pupa is also aquatic, having long respiratory filaments attached to each side of the front of the thorax. According to Westwood, "the posterior part of its body is enclosed in a semioval membranous cocoon, which is at first formed by the larva, the anterior part of which is eaten away before changing to a pupa, so as to be open in front. The imago is produced beneath the surface of the water, its fine silky covering serving to repel the action of the water."

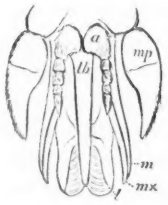
Multitudes of a long slender white worm may often be found living in the dirt, and sour sap running from wounds in the elm tree. Two summers ago we discovered some of these larvæ, and on rearing them found that they were a species of *Mycetobia* (Pl. 12, fig. 3; *a*, larva; *b*, pupa). The

larva is remarkable for having the abdominal segments divided into two portions, the hinder much smaller than the anterior division, and its whole length is .36 of an inch. The pupæ were found sticking out in considerable numbers from the tree, being anchored by the little spines at the tail. The head is square, ending in two horns, and the body is straight and covered with spines, especially towards the end of the tail. They were .20 of an inch in length. The last of June the flies appeared, somewhat resembling gnats, and about .10 of an inch long. The worms continued to infest the tree for six weeks, the flies remaining either upon or near the tree.

We now come to that terror of our equine friends, the Horse-fly, Gad, or Breeze-fly. In its larval state, some species live in water, and in damp places under stones and pieces of wood, and others in the earth away from water, where they feed on animal, and, probably, on decaying matter. Mr. B. D. Walsh found an aquatic larva of this genus, which, within a short time, devoured eleven water snails. Thus at this stage of existence, this fly, often so destructive, even at times killing our horses, is beneficial. We have found a larva (Pl. 12, fig. 4), which is, probably, a young Horse-fly, living in abundance on the under side of the stones in a running brook, at Burkesville Junction, Va. The body was smooth, over two inches in length, and with a few fleshy filaments at the tip. Each segment is enlarged posteriorly, aiding the creature in moving about. During the hotter parts of summer, and when the sun is shining brightly, thousands of these Horse-flies appear on our marshes and inland prairies. There are many different kinds, over one hundred species of the genus Tabanus alone, living in North America. Our most common species is the "Green-head," or *Tabanus lineola* Fabr. (Pl. 12, fig. 5; from Tenney's Zoölogy). When about to bite, it settles quietly down upon the hand, face or foot, it matters not which, and thrusts its formidable lancet jaws deep into the flesh. Its bite is very painful, as

we can testify from personal experience. We were told during the last summer that a horse, which stood fastened to a tree in a field near the marshes at Rowley, Mass., was bitten to death by these Green-heads; and it is known that horses and cattle are occasionally killed by their repeated harassing bites. In cloudy weather they do not fly, and they perish on the cool frosty nights of September. The Timb, or Tsetze-fly, is a species of this group of flies, and while it does not attack man, plagues to death, and is said to poison by its bite, the cattle in certain districts of the interior of Africa, thus almost barring out explorers. On comparing the mouth-parts of the Horse-fly (Fig. 3, mouth of *T. lineola*), we have all the parts seen in the mosquito, but greatly modified. Like the mosquito, the females alone bite, the male Horse-fly being harmless, and frequenting flowers, living upon their sweets. The labrum (*lb*), mandibles (*m*), and maxillæ (*mx*), are short, stiff, and lancet-like, and the maxillary palpi (*mp*, the five terminal points of the antennæ) are large, stout, and two-jointed. While the jaws (both maxillæ and mandibles) are thrust into the flesh, the tongue (*l*) spreads around the tube thus formed by the lancets, and pumps up the blood flowing from the wound, by aid of the sucking stomach, or crop, being a sac appended to the throat. Other Gad-flies, but much smaller, though as annoying to us in woods and fields, are the species of Golden-eyed flies, *Chrysops*, which fly and buzz interminably about our ears, often taking a sudden nip. They plague cattle, settling upon them and drawing their blood at their leisure.

Fig. 3.



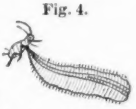
We turn to a comparatively unknown insect, which has occasionally excited some distrust in the minds of housekeepers. It is the Carpet-fly, *Scenopinus pallipes* Say (Pl. 12, fig. 6), which, in the larva state, is found under carpets, on which it is said to feed. The worm (Pl. 12, fig. 7) has a long, white, cylindrical body, divided into twelve segments,

exclusive of the head, while the first eight abdominal segments are divided by a transverse suture, so that there appears to be seventeen abdominal segments, the sutures appearing too distinct in the cut. Mr. F. G. Sanborn has reared the fly, here figured, from the worm. The larva also lives in rotten wood; it is too scarce to ever prove very destructive in houses.

One of the most puzzling objects to the collector of shells or insects, is the almost spherical larva of *Microdon globosus* Fabr. (Pl. 12, fig. 8; fig. 8 *c*, larva just before pupation; *a*, puparium; *s*, spiracular tubercles; *v*, vent; *b*, anterior view of pupa case), which has been traced to its fly-state by Mr. F. G. Sanborn.

The Syrphus fly, or Aphis-eater, deserves more than the passing notice which we bestow upon it. The maggot (Fig. 4, in the act of devouring an Aphis) is to be sought for established in a group of plant-lice (Aphis), which it seizes by means of the long extensible front part of the body. The adult fly (Pl. 12, fig. 9) is gaily spotted and banded with yellow, resembling closely the wasps, and frequents flowers.

Fig. 4.



We have figured in the NATURALIST (p. 278) the singular rat-tailed pupa-case of Eristalis, and now present the figure of an allied fly, *Merodon Bardus* Say (Pl. 12, fig. 10; *a*, puparium, natural size). We will not describe at length the fly, as the admirable drawings of Mr. Emerton cannot fail to render it easily recognizable. The larva is much like the puparium or pupa-case, here figured, which closely resembles that of Eristalis, in possessing a long respiratory filament, showing that the maggot undoubtedly lives in the water, and when desirous of breathing, protrudes the tube out of the water, thus drawing in air enough to fill its internal respiratory tubes (tracheæ). The *Merodon Narcissa*, also reared by Mr. Sanborn, probably lives in the soil, or in rotten wood, as the pupa-case has no respiratory tube, having instead a very short sessile truncated tube, scarcely as

long as it is thick. The case itself is cylindrical, and rounded alike at each end.

We now come to the Bot-flies (*Œstridæ*), which are among the most extraordinary, in their habits, of all insects. The history of the bot-flies is in brief thus: The adult two-winged fly lays its eggs on the exterior of the animal to be infested. They are conveyed into the interior of the host, where they hatch, and the worm or maggot lives by sucking in the purulent matter, caused by the irritation set up by its presence, in its host; or else the worm itself, after hatching, bores under the skin. When fully grown, it quits the body and finishes its transformations to the fly-state under ground. Many quadrupeds, from mice, squirrels and rabbits, up to the ox, horse, and even the rhinoceros, suffer from their attacks, while man himself is not exempt. The body of the adult fly is stout and hairy, and it is easily recognized by having the opening of the mouth very small, the mouth-parts being very rudimentary. The larvæ are, in general, thick, fleshy, footless grubs, consisting of eleven segments, exclusive of the head, which are covered with rows of spines and tubercles, by which they move about within the body, thus irritating the animals in which they take up their abode. The breathing pores (stigmata) open in a scaly plate at the posterior end of the body. The mouth-parts (mandibles, etc.) of the subcutaneous larvæ consist of fleshy tubercles, while in those species which live in the stomachs and frontal sinuses of their host, they are armed with horny hooks. The larvæ attain their full size after moulting twice. Just before assuming the pupa state, the larva leaves its peculiar dwelling-place, descends into the ground and there becomes a pupa, though retaining its larval skin, which serves as a protection to it, whence it is called a "puparium."

Several well-authenticated instances are on record of a species of bot-fly inhabiting the body of man, in Central and South America, producing painful tumors under the

skin of the arm, legs and abdomen. It is still under dispute whether this human bot-fly is a true or accidental parasite, the more probable opinion being that its proper host is the monkey, or dog. In Cayenne, this revolting grub is called the *Ver macaque* (Pl. 12, fig. 11); in Para, *Ura;* in Costa Rica, *Torcel;* and in New Grenada, *Gusano peludo*, or *Nuche*. The *Dermatobia noxialis*, supposed to be the *Ver moyocuil* of the inhabitants of Mexico and New Grenada, lives beneath the skin of the dog.

The Bot-fly of the horse, *Gastrophilus equi* (Pl. 12, fig. 12; from Tenney's Zoölogy; *a*, larva), is pale yellowish, spotted with red, with short, grayish, yellow hairs, and the wings are banded with reddish. She lays her eggs upon the knees of the horse. They are conveyed into the stomach, where the larva lives from May until October, and when full grown are found hanging by their mouth-hooks on the edges of the rectum of the horse, whence they are carried out in the excrement. The pupa state lasts for thirty or forty days, and the perfect fly appears the next season, from June until October.

The Bot-fly of the ox, *Hypoderma bovis* (Pl. 12, fig. 13; fig. 14, larva), is black and densely hairy, and the thorax is banded with yellow and white. The larva is found during the month of May, and also in summer, living in tumors on the back of cattle. When fully grown, which is generally in July, they make their way out and fall to the ground, and live in the puparium from twenty-six to thirty days, the fly appearing from May until September. It is found all over the world. The *Œstrus ovis*, the sheep Bot-fly, is of a dirty ash color. The abdomen is marbled with yellowish and white flecks, and is hairy at the end. The larva lives, during April, May and June, in the frontal sinus of the sheep, and also in the nasal cavity, whence they fall to the ground when full grown. In twenty-four hours they change to pupæ, and the fly appears during the summer.

We also figure the *Cuterebra buccata* (Pl. 12, fig. 15; *a*,

side view; from the collection of Mr. F. G. Sanborn), which resembles the ox Bot-fly in the larval state. Its habits are not known, though the young of other species infest the opossum, squirrel, hare, etc., living in subcutaneous tumors. —*To be concluded.*

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

(Continued from page 538.)

II. BIRDS.

TURKEY BUZZARD (*Cathartes aura*). Occasionally seen through the Rocky Mountains, but not very common.

PIGEON HAWK (*Falco columbarius*). I saw no Pigeon Hawks until I reached Cœur d'Aleñe Mission, where I obtained the very fine specimen preserved.

SPARROW HAWK (*Falco sparverius*). Common in all open regions.

MEXICAN HAWK (*Accipiter Mexicanus*). No. 92 (♂?). Bitterroot river, September 2. Length, 16.50; extent, 27.50; wing, 9. Iris and feet greenish yellow. This specimen and the next would be supposed to be of the same species, but their dimensions differ too much, and do not agree well with those of either of the three *Accipitres*, in which "size is a specific character." (Cassin).

SHARP-SHINNED HAWK (*A. fuscus*). No. 82 (♀?). Bitterroot river, August 30, 1860. Length, 14; extent, 26.75; wing, 5.50. The sex of these last two specimens being uncertain on account of their youth, I can only guess at it from their dimensions, and the wing in this one is very short, even for a male bird.

Hawks were rather scarce during my stay in the Rocky Mountains, the older birds having probably left the valleys to

Fig. 12, *a*.

Fig. 6.

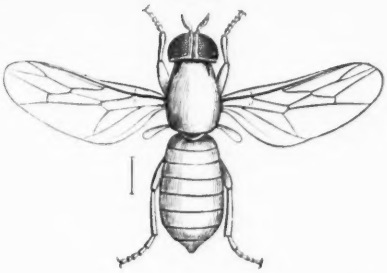


Fig. 11.

Fig. 5.

Fig. 8.

Fig. 8, *a*.

Fig. 8, *b*.

Fig. 7.

Fig. 2.

Fig. 4.

Fig. 13.

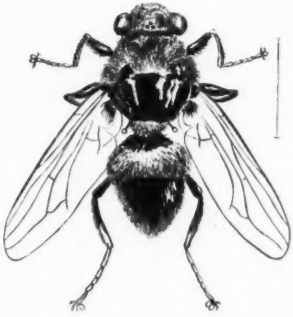


Fig. 14.

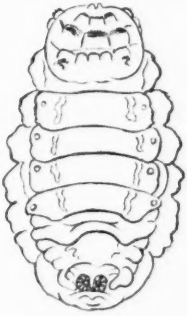


Fig. 8, *c*.

Fig. 1.

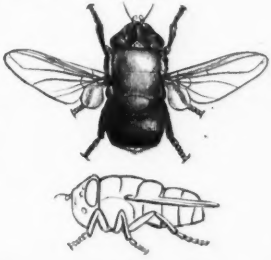
Fig. 9.

Fig. 12.

Fig. 3.

Fig. 10.

Fig. 15.



PACKARD ON FLIES.

— THE —
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raise their young in the higher forests, and the young just began to appear in the end of August.

Marsh Hawk (*Circus Hudsonius*). The Marsh Hawk is probably the most universally diffused hawk on the continent, and is seen almost daily at all seasons, where there are open prairies or meadows and not much population.

Golden Eagle (*Aquila Canadensis*). Though I did not see the Golden Eagle in the Rocky Mountains, so near as to be sure of the species, it evidently inhabits them, as I saw several young ones at Fort Benton, which had been trapped by the Indians soon after they could fly, and were doubtless raised in the mountains. They probably find prey more easily caught on the Great Plains, and have not yet been observed west of the mountains where the White-headed Eagle is so abundant, while the latter is quite scarce on the plains, though sometimes seen.

Fish Hawk (*Pandion Carolinensis*). Not seen near the muddy waters of the Missouri below Fort Benton, but common, and its nests numerous on the rivers, and their branches from there westward, where it finds an abundance of delicious trout and other fish in the clear streams.

Wilson's Owl (*Otus Wilsonianus*). A specimen was knocked down by a soldier with a stick near Bitterroot ferry, Sept. 4th, and I rode close by one sitting in a bush near Cœur d'Aleñe Mission, on the 15th, so that it seems to be generally distributed across the continent, being common also in the bushes along streams on the plains. It seems indeed to shun dense forests, not having been observed by me west of the Cascade Mountains.

Yellow-billed Cuckoo (*Cocygus Americanus*). I saw this Cuckoo near Fort Benton, but not in the Rocky Mountains, although it may have left for the south when I reached there (Aug. 15), as it departs early. I should expect to find it a month earlier, as Nuttall "met with it in Oregon." (Mammal, I, 652.)

Harris's Woodpecker (*Picus Harrisii*), and Gairdner's

Woodpecker (*P. Gairdneri*) were seen abundantly from the eastern base of the mountains westward.

White-headed Woodpecker (*Picus albolarvatus*). First met with by me, as in 1853, at the Spokan river, September 24; and at Fort Colville, a week later, I saw several. They were very shy, and made a shrill note of alarm, much like that of some squirrels, for which I at first looked out on hearing it. At Fort Dalles, I found a family of them associating near the quarters, and quite tame, so that I obtained three fine specimens. They prefer open pine woods, and seek for food chiefly in the bark of the Yellow-pine (*Pinus ponderosa*), the prevailing tree in the above localities. In notes and habits they most resemble the small Sap-suckers, and associate with them.

Arctic Woodpecker (*Picoides arcticus*). I first met with the large Three-toed Woodpecker, at the crossing of the Bitterroot, September 6th, where the open woods, before traversed, were exchanged for a very dense growth, with several kinds of common spruce, which had not been before seen. In these dark forests I found this and the striped species (*P. dorsalis*) the commonest woodpeckers, but also saw many of this kind afterwards in the more open pine forests between Spokan river and Fort Colville, where I also saw them in October, 1853.

Striped-back Woodpecker (*Picoides dorsalis*). No. 100 (♂), shot September 7th, near crossing of Bitterroot river. Length, 9.75; extent, 15.25; wing, 4.75. No. 104 (♀), shot September 9th, at dividing ridge of Cœur d'Aleñe Mountains. Length, 8.50; extent, 14.50; wing, 3.75. Iris, brown; bill, slaty black; feet, gray in both. I saw this species but once besides, at the west base of the same mountains. At each time I found it very silent (being led to it by its tapping on the trees), quite fearless, and frequenting only the low, generally fallen trunks, in the most dense part of the forest. I had, of course, little opportunity to notice its habits farther than this. All seen were at an

elevation of over 3500 feet above the sea, but not in an Alpine region, at least in September, though there was slight frost at night, and snow falls from three to six feet deep in winter.

Red-necked Woodpecker (*Sphyrapicus nuchalis*). I first met with this beautiful species along the Hell Gate river, August 25th (No. 73), and afterwards found it rather common, but very shy, as far as the Bitterroot crossing. It was not seen in the dense forests west of this, but reappeared quite abundantly, though moulting and bad in plumage, at the Cœur d'Aleñe Mission. I suppose, therefore, that it extends around the north end of these mountains through the valley of Clark's Fork. I commonly found it frequenting dense thickets of willows, etc., tapping their bark, and once saw one on a high spruce tree. (I had some doubts whether the larger specimen, No. 118, was not the young of *S. ruber*, but think *not*.)

Red-headed Woodpecker (*Melanerpes erythrocephalus*). I saw a Red-head Woodpecker high on the eastern slope of the Rocky Mountains, but none on the west side.

Lewis' Woodpecker (*M. torquatus*). This bird is quite common at the eastern base of the Rocky Mountains, thus visiting the regions inhabited by its cousin, the Red-head, which does not seem, however, to return the civility. The habits of the two species are very similar, but this species is, perhaps, more of a berry eater and less of a hard worker. I found it much less common on the western slopes of the Rocky Mountains than it is between the Cascade and Coast ranges.

Red-shafted Flicker (*Colaptes Mexicanus*). This Flicker is common throughout the Rocky Mountains, but I noticed none of the hybrid variety common along the Missouri and its branches, which were obtained by Dr. Suckley as far west as Milk river in 1853, and by myself at Fort Laramie.

Chimney Swallow (*Chætura pelasgia?* or *Vauxii?*). I did not notice Chimney Swallows along the lower Missouri,

but near the Great Bend, and at other points above there, as far as the mouth of Milk river, I found large numbers inhabiting old hollow cotton-woods. They seemed smaller and with a whiter throat than *C. pelasgia*, but I did not succeed in shooting any. None occurred west of this point.

Night-hawk (*Chordeiles Henryi?*). Night-hawks were common all the way across the mountains, until September 18th, when a heavy frost occurred at the Cœur d'Aleñe Mission and drove them south with the Cliff Swallows, which were flying about camp with them on the previous afternoon. Myriads of them flew about, high over the small prairies along Hell Gate river, in the calm warm afternoons, near the end of August, just as the common eastern species does later in the season, and with the same loud cry.

The specimen preserved was shot at Sun river, east of the mountains, August 10th, and I found eggs on the bare ground both at Judith river, June 29th, and near Prickly-pear Creek, August 18th, the latter broken, and with nearly hatched young; probably a second brood.

Specimens of Night-hawks, from both sides of the continent, being "undistinguishable" (Baird's Birds, p. 152), the slight differences in plumage, of the intermediate Rocky Mountain form, seem scarcely enough to separate it, while its habits seem precisely similar. (See Baird's Rep., Pacific R. R. Survey, Vol. IX, App., p. 922.)

Belted Kingfisher (*Ceryle Alcyon*). Not seen along the muddy portion of the Missouri, but common from Fort Benton westward.

Kingbird (*Tyrannus Carolinensis*). Found at intervals throughout the valleys of the Rocky Mountains, and found also at Fort Vancouver, on the Lower Columbia, in 1853, though it has never been observed in California, and would seem, therefore, to pass to the west coast by this roundabout way. — *To be continued.*

REVIEWS.

FERNS.*—This valuable addition to the library of the student of Ferns, long waited for, and delayed in its first stages of publication by the death of its venerable and learned author,† has been brought out in parts, and at length completed, in accordance with the desire of Sir William Hooker, by Mr. Baker, who has assumed its authorship so far as to add, to the already prepared manuscript, descriptions of new species of Ferns received after that had been written, and to put the whole in condition for publication.

The title of the book, "Synopsis Filicum," conveys the idea of a brief and condensed description and notice of the "known Ferns," and such it is, while it also plays the part of a supplement to the "Species Filicum"‡ of the same author, upon which he was engaged for many years. As the preface tells us, "the Author, having recently completed his 'Species Filicum,' now offers to the public a 'Synopsis of all known Ferns,' which contains, besides brief diagnoses of the species described more in detail in that work, together with their geographical distribution as far as yet ascertained, such additions and corrections as have come to his knowledge * * * *".

One thing to which special reference is made in the preface is, that all descriptions of ferns, which have been so badly or carelessly drawn up that it is impossible to identify which of a number of species a description refers to, and which Pteridologists have, with much labor, and much detriment to true progress in their science, dragged along after them, have been omitted and ignored. This at once reduces very much the number of specific names, and as they are nothing but names, it is a great relief.

The forms considered worthy to rank as species have been somewhat reduced in number by the authors, since they have regarded as varieties numerous plants described by others as species. In much of this we certainly concur, but in some cases should wish to record a difference of opinion. It must be acknowledged, however, that the authors have had the advantage of the largest Fern Herbarium in existence, the formation of which began as far back as 1811, and any one who has handled numerous specimens of ferns cannot but have observed how some forms pass through intermediate stages, into what appear at first to be quite different plants.

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* Synopsis Filicum; or a Synopsis of all known Ferns, including the Osmundaceæ, Schizæaceæ, Marattiaceæ, and Ophioglossaceæ (chiefly derived from the Kew Herbarium): Accompanied by figures representing the essential character of each Genus. By the late Sir William Jackson Hooker, K. H., D. C. L., F. R. S., A. S., and L. S., Director of the Royal Gardens of Kew, and John Gilbert Baker, F. L. S., Assistant Curator of the Kew Herbarium. London: Robert Hardwicke, 192 Piccadilly. 1868. 8vo, pp. 482, tt. 11.

† This is the separate work of Sir W. J. Hooker.

‡ In 5 vols, 8vo, with three hundred plates representing upwards of five hundred species.

A convenience in the arrangement of the book is the list of the (75) genera, placed under their respective suborders and tribes, which is given at the beginning. The generic characters are given in as few words as is consistent with intelligibility, and the species are described in much the same manner, all the words of frequent use being abbreviated. The greater part of the extensive synonomy, which is often of a complicated character, is left out.* The species of Hymenophyllum and Trichomanes, which have been so much multiplied by certain authors, are here reduced in the ratio of something like two hundred to five hundred. The group of ferns called Phegopteris is here considered as a part of the genus Polypodium. We should much prefer to see the view of the lamented Mettenius adopted, that they are exindusioid Aspidieæ, with which they agree in aspect and other characteristics, and where so many of them have been absorbed by the discovery of an indusium.

The inclusion of the suborders specially mentioned in the title is a great boon, for here we have them, for the first time, comprehensively described. — H. MANN.

THE PAST AND FUTURE OF OUR PLANET.† — The author says, in his preface, that he has freely used the writings of Lyell, Owen, Hall, Dana, etc., "as they had done the writings of others." Now these are the names of men who have grouped the written opinions of others around a nucleus of their own original investigations, whereas Mr. Denton has no such nucleus, the whole being a compilation. As such, however, it will be found of value to the general reader, since it brings together, in a popular manner, the researches which have been made in the geology and palæontology of the United States, and which can only be found elsewhere in Professor Dana's unsurpassed Manual of Geology.

The author adopts without question, the disputed view that the earth is a molten mass covered by a thin crust, in spite of Lyell and Hopkins.

The successive order of the appearance of animals is given as Radiates, Mollusks, Articulates, and Vertebrates, whereas it is well known that the three first appear simultaneously. The Protozoa are wholly ignored and although it is rather too soon to speculate about them, we think the author ought, at least, to have made more than a passing allusion to the important discovery of the Eozoön. Trilobites are said to have no feet, whereas every naturalist supposes that they must have had soft rudimentary appendages, and some have supposed that they made the tracks found in the Potsdam sandstone and elsewhere.

The explanation of the different ages of granite is very apt to mislead the reader into the belief, that the more modern granites have only been formed in the centre, and spouted up in veins through the later rocks, whereas it occurs in masses just as the older granites occur, and not differing except in age.

The illustrations are extremely poor, but the lectures are popular,

* The student is expected to refer to the Species Filicum for that.

† The Past and Future of our Planet. By William Denton. 8vo, pp. 344. Boston, 1868.

likely to interest and please uninstructed minds, and with the exceptions noted, we think are reliable. The chapter on the future of our planet is an imaginative picture of the manner in which mankind may eventually utilize the forces of inorganic nature.

The Fauna of the Gulf Stream at great depths.*—The investigations ordered by the new Superintendent of the Coast Survey, Professor Pierce of Harvard College, into the marine fauna of the Gulf stream, in connection with the regular duties of the survey, have begun to produce its natural result, in such valuable contributions to science, as we have now before us. The line of the present survey was "in a section between Key West and Havana, incidentally with the purpose of sounding out the line for the telegraph cable." Although the work was interrupted, and the casts made with the dredge few, "the interesting fact was disclosed, that animal life exists at great depths, in as great a diversity and as great an abundance, as in shallow water." By two casts in two hundred and seventy fathoms off Havana, Crustacea and Worms, numerous dead shells of Gasteropods and Pteropods, living Terebratulæ, and seven species of Bryozoa, besides Echini, Starfishes, and an abundance of Corals, Hydroids, and Foraminiferæ were taken. Only one species of sea-weed, however, was mixed with this luxuriant animal life, which corresponds with similar results of deep sea dredging in the European seas, and shows that "the greater number of deep sea-animals must be carnivorous." They found, also, that a porous limestone was in process of formation, "composed apparently of the remains of the same animals which were found living." In a cast made in three hundred and fifty fathoms, nothing was brought up but a few dead corals. "The Echinoderms appear to have a wide distribution in depth," and the Gorgonias (sea-fans) are represented in two hundred and seventy fathoms, by at least two species known to belong to the West Indian fauna, in moderate depths. The results of this attempt are certainly very interesting and important to marine zoölogy, although no casts were made in the deepest parts of the channel.

With our present knowledge, it is premature to assume the existence of the higher forms of animal life in the profound abysses of the Atlantic and Pacific Oceans, but dredging in the Gulf of Mexico may be carried to such a depth as to have a most important, if not decisive bearing upon this question, since the Coast Survey have sounded over nine thousand feet in one instance, and several times to the extent of six thousand feet.

Dredging has been very recently carried on at enormous depths by the Scandinavian expedition to Spitzbergen, for it is stated, in the November number of the Annals and Magazine of Natural History, that Messrs. Malmgren and Smitt have dredged up a variety of animals from a depth of 2,000 feet, near Spitzbergen.

The Butterflies of North America.—The second part of this beautifully illustrated work has appeared, and we desire again to commend

*Bulletin of the Museum of Comparative Zoology. No. 6. Contributions to the Fauna of the Gulf stream at great depths. By L. F. Pourtales, Ass't U. S. Coast Survey.

the fine style in which the work is issued. The colored lithographic plates are unsurpassed, and the letter-press is in every way excellent. We trust the publishers will feel encouraged to continue the work, so that every species of butterfly, together with its caterpillar and chrysalis, in our territory, may set for its portrait. When completed and bound, it will make a beautiful ornament for the centre table. The present number figures various species of Argynnis, Colias, and Apatura. Published by the American Entomological Society, Philadelphia. $2.00 a Part.

Review of the Scandinavian Publications in Natural History during 1867 and part of 1868. By Dr. Lütken of Copenhagen. — Prof. Reinhardt has described two new species and one new genus of fresh-water snakes, *Tachyplotus* (new genus) *Hedemanni* from Billiton and *Helicops assimilis* R., from Lagos Santa, both illustrated by woodcuts. He further gives us the first good figure ever published of the true *Delphinus delphis*, and in a postscript to the observations made by Mr. Hallar, the surgeon of a whaling cruiser, near Iceland in 1867, he demonstrated the identity of the "Strypireydr," of the Icelander, with the little known *Balænoptera Sibbaldii*. The cranium, atlas and os hyoideum of this species of whale are described in detail and figured. Mr. A. Bœck has contributed an interesting paper on two species of truly symmetrical (bilaterally formed) jelly-fishes, related to *Willsia*, but forming a new genus, *Dipleurosoma;* the typical species was observed by the author in the Norwegian Sea; the other is established on a drawing made by the late Mr. Stüwitz, probably in the American part of the Atlantic, near Newfoundland. In another paper Mr. Bœck clears up a question that has considerably puzzled earlier inquirers, in describing the nervous system of *Nemertes*, from his own researches and those of his father (Professor Chr. Bœck in Christiania). He points out the various errors committed by all previous investigators, and demonstrates the composition of the central mass (or brain), which consists of an outer, reddish, granular substance, and an inner yellowish filamentose one (both papers are illustrated by wood-cuts). Professor Steenstrupt's paper on the "Original character of the Terrestrial Mammalian Fauna of Iceland" starts from the hypothesis proposed in Mr. Murray's work on the Geographical Distribution of Mammals, that the field mouse of Iceland might be a species of *Myodes*, and probably one of the American species, thus impressing an American stamp on the primitive fauna of this island; this mammal being in part the *only* one, which, with any degree of probability, can be regarded as aboriginally Irish. He proves that the said mouse is, after all that is known about it, a true *Mus*, closely allied to, if not identical with, the *Mus sylvaticus* of Scandinavia; no single specimen of *Myodes* was ever caught or heard of in Iceland, neither by the author during his stay in that country, nor by others. Mr. Warming, a young botanist lately returned from a three years sojourn in Brazil, in the house of Dr. Lund, at Lagos Santa, has opened a series of "Symbolæ ad Floram Braziliæ centralis cognoscendam." The introduction, illustrated by two physiotyp-

ical plates, is written in Latin, and treats of the *Cordiaceæ*, *Asperifoliæ*, *Voshyriaceæ*, and *Mayaceæ*. Of greater popular interest your reader would no doubt find the same author's "Observations on the Evolution of Heat in a Species of Aroid," made during his stay in Brazil. The description of the new Aroid (Phyllodendron Lundii) is illustrated by a plate. Professor Lange has worked up the *Monotropes* and *Pyroleæ*, collected by Professors Liebmann and Œrsted in Mexico and Central America. The paper is written in Latin, and illustrated with two plates. Professor Œrsted has given an additional note to his former description of the Brazilian Tea-plant (Neea theifera), and described the dimorphous flower of *Halesia tetraptera*, whose minute male flowers have hitherto been unknown; both species are illustrated by woodcuts. I should be inclined to attach considerable importance to the same naturalist's elaborate essay on the Classification of Oaks; after a critical analysis of the labor of his predecessor in this field, and a detailed examination of all parts of their morphology, the author puts forward his own views on the subject, imparting not only a reformed subdivision in genera, subgenera, sections, etc., but also an altered line of demarcation between the *Faginæ* and the *Castaninæ;* so that the numerous (chiefly East Indian) species of *Pacania* and *Cystobalanus* are removed from the true oaks, and referred to the chestnuts. A more detailed abstract of the new facts and views brought forward by Professor Œrsted (whose paper is illustrated by numerous woodcuts, physiotypical figures and two plates) it will be unnecessary to bestow, as the whole paper is reprinted in a French translation as an introduction to the splendid volume shortly to be published by the Royal Academy of Science, under the title, "Chênes de l'Amerique tropicale; Monographiè des espèces nouvelles et peu connues, ouvrage posthume de M. Liebmann, achevè et augmente d'un aperon sur la classification des Chênes en general par A. S. Œrsted"; large folio with many excellent plates; a work that without any recommendation of mine, will excite the high interest of American botanists. Besides the said paper of Mr. Œrsted on the Classification of Oaks, it contains a "Notice sur la vie de Liebmann et specialement sur sou Voyage en Mexique," with a list of his publications, ten plates, with physiotypical figures of leaves, and forty-seven engraved plates, representing species of oaks from tropical America.

In the second volume of the Journal of Botany, published by Dr. Heiberg for the Botanical Society of Copenhagen, you will find several contributions to the Phanerogamic and Cryptogamic (mosses, lichens) Flora of Denmark. Rev. Mr. Lange has contributed a paper on the Mosses of Tuscany; Professor Lange one on the Dimorphous Seeds of *Atriplex hortensis*, and the editor a Monographical and Anatomical Description of *Eleocharis palustris* (with three plates). Among the many interesting verbal communications, of which short abstracts are given in the Bulletin of the meetings of the Society, I shall particularly draw the attention to Dr. Heiberg's valuable report on the Phanerogamic Parasitical Plants of Denmark. Of the venerable Flora Danica, the forty-sixth fascicle has appeared. The editor, Professor Lange, has also published his annual Index Semipum of

the University Botanical Garden. Colonel Jenscen-Tusch has commenced the publication (supported by the Royal Academy of Science) of a work on the popular names of plants in different European languages: the first volume is devoted to the Scandinavian names. As the Journal of Natural History (Prof. Schiödte, editor) is regularly reviewed by a widely distributed English Journal, I shall confine myself to stating that the lately published Part I. and II. of Vol. V, contains two papers, by Dr. Meinert, on Danish Myriapoda (forming, with a former paper by Drs. Meinert and Bergsöe, a complete account of this part of our fauna), and a paper on Duple Spermatic Ducts in Insects (a continuation of his previous contributions to the anatomy of the Earwig). Professor Schiödte's paper on the Manner in which the Position of the Eyes is developed in Flounders (translated in the Annals of Natural History), and finally an elaborate account of the Danish Cladocerous Crustacea, by Mr. P. E. Müller, followed by some very valuable contributions to the knowledge of their propagation (with seven plates). I have no doubt that these two papers belong to the most accomplished essays ever published on this order, whose study is, I believe, almost entirely neglected in America. In the Journal of Fisheries, published by Messrs. Fiedler and Feddensen, Professor Kroyer has announced the occasional occurrence on the shores of Denmark of the Pilchard, and of a new species of Paralepis (*P. Atlanticus*). Mr. Bœck has forwarded the first part of an Essay on the Lobster of Norway, and the history of its fishing. Professor Rasch's address at the International Exhibition of Fisheries, at Bergen in 1865, on Oyster Culture, is reprinted. Finally, I beg leave to observe that in the Journal for Popular Papers on Natural Science, edited by Mr. Fogh and myself (and concluding now its fifteenth year), Mr. Warming has published his "Souvenir," from the Brazilian campos, and described a fine phenomenon, a marine "Ignis fatuus," observed by himself in the Atlantic at 15° Lat. N., and 30° Lon. W., while I have myself endeavored to collect the most important evidences concerning the Mammoth, and the animals exterminated or brought to the verge of extermination through man's intrusion upon nature in historical times. Professor Steenstrupt's paper on the French Bone-caves, and Professor Loven's instructive and elegant address at the meeting of Scandinavian naturalists, in 1863, on the Baltic Sea, are reprinted. Of Professor Reinhardt's most valuable account of the Brazilian Bone-caves, and their animal remains, I have reported in your journal on a former occasion. Of the Proceedings of the Academy of Christiana, only the volume for 1866 has reached me. Professor Sars has described and figured a new species of the arctic genus of fishes, Lycodes (L. gracilis), dredged at great depth in Christianafjord, and continued his examinations of the clay-balls from the glacial epoch. In those described on this occasion he found remains of *Osmerus arcticus*, *Gadus polaris*, and *Cancer pagurus;* in those hitherto found and examined in Norway, he has discovered in all one Pennatulid, one Ophiurid, five Worms (chiefly Chætopods), five Bivalves, five Crustacea, and two Fishes. Professor Sars suggests collecting fuller series of these concretions, which would, no

doubt, give valuable results, and making a special study of them. They have been found hitherto only in Greenland, Canada, and Norway.* Prof. C. Bœck has described in the Proceedings, for 1860, a couple of horns of a hitherto unknown species of buffalo, from Southern Africa, under the name of *Bos longicornis*, and has since that time procured farther evidence about this animal from the Rev. Mr. Schreuder, Bishop of the Norwegian mission in the Zulu territory, who had himself formerly sent the horns to the Museum of Christiania. They were those of a wild buffalo-cow, shot at Eutumeni, and belonging to a troop which suddenly made its appearance in the country, and excited some stir because of their uncommon size and large horns; those of the bull were much greater; the color of the skin was brown. After a stay of some time in the neighborhood of Eutumeni, the troop disappeared from the country and was no more heard of. Probably it was a stray party from a more distant part of Africa, but nevertheless it is singular enough that a peculiar species of wild ox, distinguished alike by its great bulk and extraordinary appearance, and roaming over the plains of South Africa, should have remained totally unknown to the explorers, travellers, and residents of the country; only known in fact from a couple of horns, picked up and sent far away to the most distant University of the other half of the globe! Professor Rasch, the indefatigable fish cultivator, has published the results of some valuable experiments conducted with the view of producing hybrids between different species of *Salmonidæ*. In no class of animals, we are justly told, are there experiments more easily made, and nowhere can it be more easily decided whether the rule of sterility in hybrids is absolute or not. The spawn of the sea-trout, fecundated with the milt of the fresh-water trout, gave an equally high per centage of vigorous brood, as if both parents had been either of the one or the other variety, and the brood itself was not less fertile than if no crossing at all had taken place, thus confirming the views of Dr. Widegren, that the sea-trout and fresh-water trout are only varieties of the same species, an opinion also entertained by Professor Rasch since 1850, when he observed that the brood of the sea-trout, living together with that of the fresh-water trout, was quite undistinguishable from the latter, either in habits or in appearance, as is also the case with that of the great lake-trout of the greater Norwegian lakes, *Salmo ferox* Yarrell (*S. lacustris* Hart.); a fact bearing strongly on the vexed question of species and varieties in the genus of salmons. Spawn of the Alpine trout, or *Salvelin* (S. alpinis), fecundated by the sperm of the common trout, produced from thirty to forty per cent. of well hatched brood, but many were shortly after hatching attacked by a sort of dropsy, and in many embryos the beginning of development was arrested, and they perished by degrees. Spawn of trout fecundated by the milt of the *Salvelin* only gave ten per cent. of brood, whereof some were misshaped. Spawn of true salmon, fecundated by the trout, pro-

* The *Mallotus villosus*, or Capelin, has been found fossil in Gardiner and Saco, Me. enclosed in clay-balls. — Eds.

duced forty per cent. of mostly well-shaped brood, but a part became afterwards dropsical; fecundated by the *Salvelin*, it developed no embryo at all! The spawn of a (presumed) hybrid of the trout and *Salvelin*, fecundated with the milt of a vigorous male trout, also gave quite a negative result. You will agree with me, that experiments of this sort, conducted with the author's skill and profound practical knowledge of the matter, are of a high scientific value. Professor Kjerulf has gathered all the available evidence concerning the earthquake felt over almost all Norway, and from Shetland to Söderhamn, at the Botnio, on the night of May 9th, 1866. The memoir of the celebrated Norwegian geologist abounds with details, allowing of no abstract; I therefore must restrain myself to mentioning that the shock was felt from Bodo (north) to Langesund (south), one hundred and thirty geographical miles, and radiated from a point situated at the south-west of Christiansund, with a velocity of six and two-thirds to seven and three-fifths geographical miles to the minute, but lasted at each spot only two minutes at the utmost. In the later volumes of the Proceedings of the Christiania Academy (known to me only from separate copies of the paper mentioned below, kindly sent to the writer), Mr. Collet has given a full topographical list of the Birds of Norway, summing up their distribution in the country, when and where they were observed, etc. Two hundred and forty-eight species are enumerated. Professor M. Sars has published short notices about some Cœlenterata (coral polyps, jelly fishes, etc.) and Echinodermata (starfishes, etc.), from the Lofoten Isles, i. e., *Thyonidium scabrum* (new species), *Holothuria natans* (new species), *Physophora borealis*, *Corymorpha* (Amathea) *Sarsii* and *Isidella* (new genus) *Lofotensis*. *H. natans* is distinguished by possessing the faculty of swimming, with snake-like motions, in a vertical direction. *Isidella*, a branching coral, was found at the great depth of three hundred fathoms, within the polar circle (68° 11′ lat. north), and is distinguished from *Isis* by its single, unbranched stem, composed of elongated calcareous joints, and very short corneous ones, and fixed to the bottom by "foliaceous radicles." The only complete specimen was eighty millimetres high, and one and a half millimetres thick, but fragments of stems three millimetres thick showed that it grew much larger. Dr. Danielsen has described two species of a new Bryozöon genus, *Kinetoskias*, found at Nordland and Finmarken, remarkable for its faculty of moving voluntarily the branches (connected by a membrane) of its polypary, expanding them in the shape of an umbrella, or closing them together into a ball (according to Dr. Smitt, whose work on the Bryozoa will be referred to afterwards). *Kinetoskias arborescens* D., is a species of *Bugula* (*B. umbrella* Smitt).

Professor Sars has published a little volume of Contributions to the Fauna of the Bay of Christiania, with descriptions and plates of new or little known Crustacea (Crangon, Pasiphaë, etc.). His son, Mr. G. O. Sars, has published a handsome volume, the first part of a careful and detailed description and anatomical "Histoire naturelle des Crustaces d'eau douce de Norvège" (les malacostracés: mysis oculata, Gammarus

neglectus, Pallasea cancelloides, Gammaracanthus loricatus, Pontoporeia affinis, Asellus aquaticus), illustrated with ten highly finished plates; the cost of publication being most generously supplied by Mr. Johnsen, Reviser of the State. From the elder Sars we may soon expect an equally well illustrated description of the remarkable new genus of stalked Crinoids (Rhizocrinus), discovered by his son in the depths of the ocean at Lofoten; and from Mr. A. Bœck, a detailed description of the Norwegian and Arctic Amphipoda, with many plates. The magnificent Geological Chart of Norway, south of the mountain-ridge (der Sönderfieldske Norge or the "stifts" of Hamar, Christiania, and Christianasand), published by Professor Kjerulf and Mr. Tellef Dahll, in ten sheets, large quarto, in the text, and profiles, etc., is the result of many years' explorations by the Geological Survey of Norway, conducted by Professor Kjerulf. Among similar works, it no doubt occupies a high place, as it fills up a great gap in the knowledge of the geological constitution of Europe, contributes considerably to the history of the earliest geological metamorphosis of the globe, and must be reckoned among the highest scientific monuments hitherto erected in Scandinavia. "Norway is now," as said Professor Steenstrupt in his speech at the meeting of the Scandinavian naturalists, this summer in Christiania, "the classical soil, not only of Zoölogy, but also of Geology."

NATURAL HISTORY MISCELLANY.

BOTANY.

We pause a moment before passing to our Botanical Miscellany, to record the sudden death, by consumption, on November 11, 1868, at the early age of twenty-four, of our fellow student and valued friend, HORACE MANN. We had almost looked upon him as our botanical editor, and have been constantly indebted to his accurate botanical knowledge and wise counsels in the editorial management of this magazine.

The country has lost a thoroughly disciplined and scholarly mind, and one of its leading and most promising botanists, and the readers of the *Naturalist* a contributor, whose reviews of botanical works, critical study and identification of their specimens, and unwritten essays promised for its pages, would have both quickened their zeal for the study of Nature, and secured for the botanical portion of the magazine a most elevated character.

THE COLCHICUM AUTUMNALE found growing wild in the wet meadows of the sub-alpine regions of Italy and Switzerland, has been seen in consid-

erable abundance in a meadow not far from the lake of Dublin, N. H., doubtless introduced, but when and how cannot be ascertained. My informant, who kindly brought me some flowers and bulbs on the third of October last, says that there were fifty or more in blossom then, and although having been noticed there for three or four years past, do not seem to have attracted any attention previously.—J. L. R., *Salem*.

The Double Saxifrage found in Danvers, Mass., three years ago, and mentioned in the November number of the American Naturalist, was a fortunate "find" of John H. Sears, of that town, an ardent and enthusiastic practical naturalist, whose modesty is as conspicuous as his acuteness of observation. To him I am indebted for a superb specimen of *Polyporus hispidus*, for showing me a locality of the rare little *Moneses uniflora*, and for many similar favors.

As early as May 4th, 1849, some flowers of the *Saxifraga Virginiensis*, all full-double and very beautiful, were brought me while residing at Hingham, Mass., gathered by a young person while "Maying" on the first of the month. My knowledge of the fact connected with this plant thus dates farther back than even Mr. Meehan's, whose idea concerning double flowers is worthy of attention. Semi "full-double" flowers of the *Thalictrum anemenoides*, were found near Cincinnati, Ohio, by my esteemed friend, the late Thomas G. Lee, as early as 1834; and on submitting the plant to a generous culture, in five years' time it produced full-double blossoms."—J. L. R., *Salem*.

Viola pedata occurs here in two varieties not mentioned in Gray's Botany, viz., white and pink; the former quite frequently. The pink variety is rare. I have only found it once or twice. I have also seen *Pogonia ophioglossoides* purely white. *Plantago prisilla* occurs here, a little east of its range (Gray's Manual, page 269). *Arisæma triphyllum* occasionally has its leaves 5–7, and more, parted.—W. P. Bolles, *New London*.

Recent Botanical Discoveries.—Mr. Berkeley opened the proceedings of the Botanical Section of the British Association, with a remarkably interesting address. He directed his remarks, first, to recent researches and speculations in Cryptogamic Botany, on which he is so well qualified to speak judicially, and then to the theory of Pangenesis. He alluded to the observations of DeBary and Cienkowski on organisms which appear to be intermediate between plants and animals, such as Myxomycetes and some forms of Monads, and confirmed the deductions which they drew from their observations. He then noticed Hallier's views as to the fungoid origin of certain diseases. At first Hallier had merely observed fungi in Asiatic cholera, but recently he had stated that in typhus, typhoid, and measles (in the blood), in variola and in vaccinia (in the exanthemes), he had found certain minute organisms which he termed Micrococci, which, when cultivated in the way known to students of moulds, etc., produced each a constant and characteristic fungus. He did not consider that Hallier had proved his case; his experiments were

far from conclusive, and he drew conclusions hastily. It was quite possible that certain fungi might occur constantly in substances of a certain chemical and molecular constitution; but this might be a case of effect instead of cause.

The recent researches of Mr. Herbert Spencer had shown by the introduction of colored fluids into the tissues of the living plant, that the sap not only ascends by the vascular tissue of plants, but that the same tissue returns and distributes the sap after it has been modified in the leaves. — *Quarterly Journal of Science, London.*

CUBAN PLANTS FOR SALE. — I have made thirteen (13) sets. The largest one contains two thousand two hundred and fifty three (2,253) species or well marked varieties. The others diminish pretty regularly to the last, which has but six hundred and thirty seven (637) species. My collections have always sold at ten dollars per hundred when our money was gold and silver, but I am willing to take the same amount now in currency. The larger sets give a very fair idea of the Cuban flora, and are fuller than any other collection of Cuban plants except three, — that of the Herbarium at Cambridge, Mass., that of the Kew Gardens, England, and one belonging to Mr. Sauvalle, of Havana. — CHARLES WRIGHT, *Cambridge, Mass.*

BOTANICAL NOTES. — I observe frequent notices of plants in the NATURALIST which produce white flowers. I have collected specimens of a white variety of *Mimulus ringens** for a number of years, which adds another to the list of albinos. Last season I detected *Nuphar Kalmiana* with two kinds of leaves, the usual floating ones, and another set of submerged ones, which were very thin, and when dry almost transparent. Are those submerged leaves usually found with the plant?† We have a Rubus in this vicinity which seems to be a connecting link between *R. strigosus* and *occidentalis.*‡ Has *Myozurus minimus* ever been found east of Pennsylvania, in the United States? I collect it here at Belleville.§ — JOHN MACOUN, *Belleville, Canada.*

[Brief botanical notes would be welcome to the NATURALIST, and we should print the most useful. — EDS.]

HEPATICA TRILOBA. — Some authors speak of a variety with five-lobed leaves. Now I think the five-lobed leaves are not the true leaves, but changed flower buds. I have some of the plants under cultivation, and frequently the bunches push up leaves (such as I send you) with five lobes. These bunches do not bear flowers, the five-lobed leaves appearing with the flowers of the other bunches, and the true leaves afterwards, coming out simultaneous with the leaves of the flowering plants.

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*There is a white var. of almost everything, even of the Cardinal flower. I think I never heard of it in the Mimulus. — A. G.

†Always in this and the ordinary *N. luteum* of Europe, etc.; very rare in *N. advena.* See Gray's Manual of Botany, revised edition, page 57. — A. G.

‡Is not this *R. occidentalis*, with white or amber colored berries? Grows in Vermont. See Gray's Manual, page 157. — A. G.

§The farthest east known, if wild. It may have come direct from Europe. — A. G.

While travelling in the Grand Traverse region of Northern Michigan last May, I observed, growing in the beech and maple woods, plants of *Trillium erythrocarpum*, which were fair representatives of metamorphosed plants. The petioles much elongated (2′–4′); leaves very large and distorted; sepals leaf-like, raised on petioles an inch or more long. The petals likewise leaf-like, colored green, with a few white lines. Even the stamens and pistils were colored green, and all vestige of the flowers had disappeared. I was so situated as to be unable to preserve any of the specimens I found. I also found *Uvularia perfoliata* Linn., bearing two, three, and even four flowers upon a single plant, which I believe to be as uncommon.—R. H. Fisher, *Mt. Etna, Ind.*

ZOÖLOGY.

The McNiel Expedition.—In the November Naturalist a short notice was given of Mr. McNiel's expedition to Central America. After about five months work in the field, and the expenditure of about all his funds, Mr. McNiel availed himself of the great liberality of the Panama Railroad Company, and Pacific Mail Steamship Company, to return home with his collections, free of cost, in order to refit and consult in regard to more extended operations, which the knowledge he had derived during his trip seemed to make most desirable. The plan is now for him to return to Nicaragua, accompanied with an assistant and competent collector and taxidermist, in the person of Mr. Walker, a student of the Peabody Academy of Science, provided about $3000 can be secured for the purpose.

The many acts of kindness received by Mr. McNiel from the officers of the Panama Railroad and Pacific Mail Steamship Companies, and their generosity, expressed in the substantial form of free passes and free transportation of materials, and the hospitality and kindly assistance received and proffered from Don J. J. and Capt. F. B. DeShon, Mr. Nelson, Mr. Sternburgh, Col. Haratzthy, Capt. Douglass, and others; and the interest in his labors and aid extended by the official authorities, secures a decided success to the continuation of the expedition; and with the assistance of Mr. Walker, who will more especially devote himself to the collecting of birds and mammals, large and valuable results are looked for with a certainty of fulfilment. It is proposed to return Mr. McNiel back to his field of work in a few weeks, so as to take full advantage of the dry season, which is far more conducive to collecting than the rainy one in which most of his collections thus far have been made. On his return, special attention will be given to archæological and ethnological matters, as well as zoölogical, and interesting results are looked for in these researches.

Among the specimens brought home by Mr. McNiel, consisting of corals, shells (marine, fresh water, and land), insects (including a large number of butterflies, beetles, and tarantulas), fishes, reptiles (including

a large living rattlesnake), and a few mammals, were two large stone pans and a "masher," discovered on the island of Corinto, on the Pacific coast of Nicaragua, having been washed out of the sand by a late heavy rain. These "pans" are very interesting, in showing that the same kind of utensils and implements of stone were in use by a forgotten race, as those now in common use by the natives of the interior of Nicaragua; for though there is no doubt of the great antiquity of the implements found on the island, yet stone "pans" of the same shape were seen by Mr. McNiel in use by the natives, for the purpose of preparing a coarse food by mashing hulled corn on the pan by means of a nearly cylindrical stone, held in both hands and used as a "masher." This fact is doubly interesting to us, as there are in the Museum of the Academy stones of similar shape, found in various parts of New England, that were undoubtedly used for an identical or very similar purpose by the aborigines of our own land.

To Col. A. Haratzthy, of Corinto, the Ethnological collection of the Academy is indebted for a most unique and ancient pair of enormous stirrups made of wood, elaborately carved, and bound with iron; and to the Messrs. De Shon, for an ancient rapier, bearing the maker's stamp of "Lisbon, 1621."

Capt. A. T. Douglass also sent an addition to our live stock, by Mr. McNiel, in the form of a most mischievous and interesting little animal, about the size of a cat, combining the mischievousness of a monkey with habits between a bear and raccoon, who, since his instalment at the Academy, has evinced a decided affection for the cat and a most manifest desire to ascertain the nature of the contents of every box and bottle in the room, and has proved to us that he is a good observer of objects of nature, if not a very discriminating naturalist. The Nicaraguan name of this interesting little fellow is "Pisota." In South America, two or three closely allied species of the genus are generally known under the name of "Coati."

As stated in the November NATURALIST, the continuance of the expedition depends on the disposal of duplicate specimens to various parties, and it is hoped that individuals and institutions wishing to have collections in the various departments, will at once send their subscriptions to the expedition fund, and state the character of the specimens they wish in return. A large number of specimens are now nearly ready to be distributed to subscribers, and there are plenty of most of the species to furnish good suites to all who apply soon. Subscriptions will be received in sums of $100 and upwards, but the larger the subscription the more satisfactory will it be to both parties, as the division of the specimens can then be carried on with less trouble and expense than if made up into small lots, and the subscriber will receive a proportionally greater number of specimens, unless only some special class of specimens is required by the subscriber.

For further information regarding the expedition, address F. W. PUTNAM, *Director P. A. S.*

AMBERGRIS. — I find in the American Cyclopedia the following account: "It is a morbid secretion of the liver of the Spermaceti Whale, found floating on the sea, sometimes on shore; it is found in the intestines of diseased whales." In 1842, the bark Spartan, from this port, killed a sperm whale that was exceedingly lean; on cutting into the whale, the lower portion of the intestine was cut off, and some small balls floated out, but only a very small portion of it was saved. In 1862, the schooner Estella, of this port, killed a lean sperm whale, from which they took sixty-six pounds of ambergris, which, on the arrival of the vessel, sold for $64 per pound. On another voyage, in the following year, the same schooner captured a whale, from which they took twenty-three pounds nine ounces, which sold for $70 per pound. Last spring a very lean whale was killed by the schooner Watchman in the West Indian seas, from which was taken thirty-eight pounds fifteen ounces of ambergris, which sold for $90 per pound, amounting to $3,504.37. These cases are all that I have found where whalers have been fortunate enough to find ambergris in whales. There is no doubt that they sometimes let carcases go that contain more value in the intestines than the whole blubber is worth. This substance, accumulating in the intestines, causes a stoppage so that nothing can pass from them; in this condition they cannot live long. I have seen sperm whales on the water that had been dead so long that the blubber was spoiled. If such die from a secretion of ambergris they would contain a large amount of that valuable substance, and it would pay well for the trouble of taking in all whales met with on the water, if the cause of their death is unknown.

The food of the sperm whale is mostly the large squid; it is the opinion of some of our whalers that the bills (a specimen of which I presented to the Essex Institute not long since) are not digested in the stomach of whales, but pass down the intestines until they come near the vent, where they accumulate and finally cause a stoppage. This they infer from the fact that they find these bills (as they call them) with the ambergris. — N. L. ATWOOD, *Provincetown, Mass.*

MOULTING OF THE SHRIMP (*Mysis*). — I enclose a few Shrimp "moults," whereof the most enormous quantity drifted ashore on Thursday, August 13, 1868. They were left by the tide in windrows, at the mouth of the river, and along the beaches for miles. I picked up a handful, and send the enclosed as of possible interest. They seemed all nearly of a size, and probably, therefore, of a uniform age. I was not aware before that the reticulated cornea of the eye was shed with the skeleton, and possibly others share my ignorance. — W. C. JOHNSON, *Newburyport, Mass.*

NEST OF THE BELTED KINGFISHER. — I notice from articles in the September and June numbers relating to the Belted Kingfisher, that Mr. Endicott and Mr. Wood disagree. I agree with the latter gentleman in saying that I have always found the holes from four to six feet in depth, and *never to the depth of eight feet*, as Mr. Endicott says, and with the exception of two cases, both of which occurred in clay banks, straight in

the direction in which they start. Mr. Endicott asks if any one have ever known them to turn to the left? In answer to his enquiry, I would like to have it distinctly understood, that in both the cases mentioned above, *the holes turned to the left*. I have sometimes found a nest of grass and sticks, but not usually. Mr. Wood says the eggs are about seven in number. I have found as many as eleven eggs in a nest, but never more than that.—C. E. Williams, *Utica, N. Y.*

GEOLOGY.

The Iowa Drift.—Since my announcement at the late meeting of the American Association for the Advancement of Science, at Chicago, of having traced up to their original ledges in North-western Iowa, and the adjacent parts of Dakota and Minnesota, the red quartzite boulders of the drift of Western Iowa, I have had the additional pleasure of following up, to its original home, much of the granite also, which is profusely scattered in the Iowa drift.

These observations of granite *in situ*, were confined to the immediate vicinity of the Minnesota river, and indeed to the bottom of its valley alone, but extending a distance of about thirty miles, being from a point a few miles below Fort Ridgley, to the mouth of the Red-wood river. These rocks, although evidently belonging to one continuous mass, are quite variable in texture and proportions of composition, even within a short distance. The prevailing color is reddish, from the great preponderance of feldspar of that color. Hornblende is always present, and sometimes preponderating to such an extent that limited portions have the characteristics of hornblendic slate. Mica is not always discernible, but can usually be detected. The quartz is mostly in small granular crystals, and is evidently the origin of a portion of the drift sands of that region. Indistinct lines of stratification can often be seen in these rocks, and they not unfrequently present the characters of gneiss. The rocks are found in place only in the river valley, for the reason that the whole region is covered deeply with drift, with a prairie surface, having a very distinct general level, down from which the river has eroded its valley during the unnumbered post-glacial centuries down to these underlying rocks. The valley now presents the appearance of a huge, well-defined, slightly tortuous ditch, about a mile wide, and something more than one hundred feet deep. Thus, as one travels over the prairie surface of the region, he sees nothing of these rocks *in situ*, but in the bottom of the valley he finds frequent large exposures of granitic rocks as characteristic as those of New England. As might be inferred from the great preponderance of feldspar and hornblende, these rocks readily disintegrate, much more so in fact than common limestone, and at the mouth of the Red-wood there are large exposures of them, reaching a hundred feet in thickness, yet in place and undisturbed, but so thoroughly decomposed, that one can crush it in his hand to the condition of ordinary soil, like that described by Professor Agassiz, as composing the Organ mountains,

near Rio Janeiro. It is evidently from this source that much of the soil and fine material of the drift of Iowa and Minnesota are derived. New England did not derive such a soil from her granites, although they contain all the elements of good soil, because their texture did not allow of their ready disintegration, while the glaciers were passing over them, as those of Minnesota did. Thus the great superiority of the soil of the North-west over that of New England, is due to the fact that the rocks of the whole region—granites, sandstones and limestones—were more easily disintegrated and ground.—C. A. WHITE.

ANSWERS TO CORRESPONDENTS.

W. C. F., Eastham, Mass.—The "silver witches," which you say is the common name for them with you, is probably the *Lepisma saccharina* Linn. It is found in damp houses, in closets, among books, and is injurious to silks and silken tapestry, we are informed by a lady living in Salem. You write "that they seem to choose the darkness, and move from one room to another by night. A wicker basket, that had been laid aside for some time, was found to contain quite a population of them. Hundreds were scalded out of it. I send one or two pieces from the basket, showing their work." We are surprised to find the Lepisma accused of doing damage by boring into wood-work, not suspecting an insect, with such a flattened and weak body, capable of boring cylindrical holes in soft wood, though it has powerful jaws.

————, Portsmouth, N. H.—In answer to your query whether the Greenland Saxifraga is a variety of S. Pensylvanica, we would say that we cannot guess at Greenland or any other Saxifrages (or any other plants at all for that matter); there are too many of them to make it a profitable employment.

L. A. M., Glen Falls, N. Y.—The caterpillars are the young of *Papilio Asterias*, the Parsnip Butterfly. The v-shaped horns thrown out from behind the head, are supposed to be organs of protection.

L. B. C., Richmond, Ind., writes that "on Monday, the 27th of April, 1868, the children found a Luna-moth (*Tropæa Luna*) under a beech tree. They brought it in, and I placed it under a glass disk, with beech, maple, and currant leaves, neither of which, however, did it eat; but on Thursday night, April 30th, it broke the point off from one of its wings, and eat it up. Friday night, May 1st, it broke off the other point and commenced devouring it, but I soon found it at its work of self-destruction and killed it. During its captivity of five days, it eat none of the leaves placed in its prison fresh, and when I killed it, it appeared as active as though it had a plenty of its favorite food. Is it natural for them to destroy themselves if kept in confinement? Or was it for want of its natural food? And what is its natural food?"

The Luna and other moths of the Silk-worm family (Bombycidæ) do not eat or take food except in the larva state, as the mouth-parts (tongue and mandibles) are aborted. Nearly all moths suck in the nectar of flowers and other sweets, but never use their jaws, which are obsolete, though well developed in the caterpillar. Did not your Luna break off her tail, and did not the fragment disappear in some other way than down her throat, which in the winged state is not adapted for swallowing, as she only lives long enough to go through a brief courtship and lay her eggs for her future progeny, taking no food during the few days of her moth-hood. The caterpillar feeds on the maple and other trees.

BOOKS RECEIVED.

Observations on the Metamorphosis of Siredon into Amblystoma. By Prof. O. C. Marsh. With a plate. New Haven, 1868. 8vo, pp. 12.

Outlines of Comparative Anatomy and Medical Zoölogy. By Harrison Allen, M. D. Philadelphia, 1869. 8vo, pp. 190.

The Canadian Entomologist. Vol. I, No. 4. November, 1868.

The Field. October 3 to November 21. London.

Synopsis of the Birds of South Carolina. By Elliott Coues, M. D. Boston, 1868. 8vo, pp. 23.

American Bee Journal. December, 1868. Washington, D. C.

Report on the Trials of Plows, held at Utica. Albany, 1868. 8vo.

Land and Water. August 8 to October 31, 1868. London.

Some Recent Additions to the Fauna of California. By J. G. Cooper, M. D. (From the Proceedings of the California Academy of Science, January, 1868.) 8vo, pp. 11.

Cosmos. October 3 to November 14, 1868. Paris.